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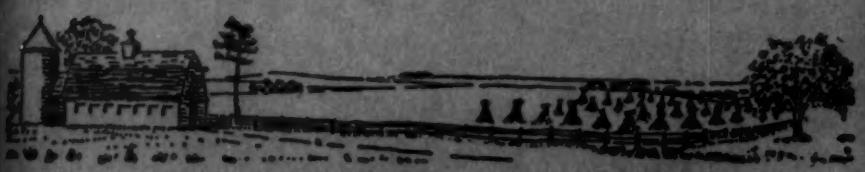

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The Farmer's Digest

Volume 13 March, 1950 Number 11

Forests Get Out of the Woods

Condensed from Nation's Business

Andrew Hamilton

FIVE years ago a committee of the California legislature reported "the forest situation is so grave that it can no longer be swept under the carpet."

Today, the Golden State has emerged as an example of what a group of state officials and enlightened business men can do if the proper leadership is provided.

Before 1944, California's 32,000,000 acres of forest lands protected by the State were plagued with fire; today, the curve is turning downward. Five years ago insects and tree diseases rampaged through the Sierra pines and Coast Range firs; at present, control measures keep them in check. Then, old-fashioned logging and sawmill practices wasted thousands of board feet of timber; now, lumbermen are seeking ways to use every part of the tree.

"We've even got California's $230,000,000 lumber industry talking about trees as a crop," says W. S. ("Bill") Rosecrans, husky, middle-aged rancher, banker and oil-man, who is chairman of the California State Board of Forestry. "That's half the battle won right there!"

A score of individuals have contributed to the development of California's new forestry program. But Rosecrans is the sparkplug and "idea man" of the outfit. Key to his success is the ability to get people with divergent points of view—lumbermen, business men, forest rangers and scientists—to talk out their differences and to agree upon a middle course.

Take for example the first meeting of the State Board of Forestry with timber owners and operators on Dec. 1, 1944, in San Francisco. It was a closed session at which Rosecrans outlined plans for a new forestry program. After he'd finished there was a long silence.

Then up rose an operator from the South Sierra region, who said sarcastically:

"I've been in the lumber busi-

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Washington, D. C., December 1949

ness for 29 years. This is the first time I have ever been *honored* by being invited to attend a meeting of any State Board of Forestry."

Rosecrans smiled. "This board has been in office only six months. Don't hold us responsible for what has happened in the first 28½ years."

"What are your proposed laws?" challenged another lumberman.

"We have no laws—yet," Rosecrans said pleasantly. "Today we are talking about ideas. When we agree we are going to ask you fellows to help us draft the laws."

"You're asking *us* to draft laws to interfere with *our* business? Why, we've been organized for 30 years to prevent just that."

The discussion continued. As old suspicions were broken down, the lumbermen agreed to go along with Rosecrans on a "well-let's-try-it" basis. In the end, the California Forest Protective Association pledged not only to help write the laws but to sponsor them in the California legislature.

Not long ago an important timber operator confessed to Rosecrans:

"Bill, if you'd told me five years ago that we would accept your plans, I would have said you were crazy or a liar!"

Bill Rosecrans is the grandson of Gen. William Starke Rosecrans of Civil War fame. Shortly after completing his education in the classics and languages at Loyola University, he rode his horse along the banks of the San Gabriel River and saw spring flood waters covering hundreds of square miles of southern California farm lands.

This began a lifelong interest in forest and watershed management—an interest expressed through membership in chambers of commerce, farm organizations, conservation groups. He serves as a trustee of two colleges and as a patron of the Greater Los Angeles Opera Association. At the end of World War II, he became president of the Southern California Council for Inter-American Affairs, brushed up on his Spanish and traveled 20,000 miles on a goodwill tour of Latin America.

A friend once asked:

"Bill, how come you've been mixed up in so many of these things?"

Rosecrans thought for a moment and then said:

"When I was still a young man, oil was discovered on our ranch. I saw there were three roads I could follow—put my nose to the grindstone and make a lot more money, chuck all responsibilities and become a playboy, or work on some of the community problems that others, perhaps, didn't have time to do. I chose the last."

It was only natural, therefore, that when the American Forestry Association in 1940 looked around for a new president it should pick

him. The selection was unique in the fact that he was the first westerner ever chosen for the job.

One example of Rosecrans' tenacity in battling for his principles: Early in the war he learned that an "emergency" proclamation to put all private forest lands under federal control had reached President Roosevelt's desk. He was able to help persuade the President that the measure was unnecessary and it was never signed.

In 1943, Gov. Earl Warren telephoned Rosecrans.

"As head of the American Forestry Association, you've been saying that the states—rather than the federal Government—should take on the responsibility and leadership for managing their forests?"

"Right."

"Well, how would you like to do something about it here in California?"

"Certainly!"

As chairman, Rosecrans helped the governor appoint the rest of the seven-man State Board of Forestry. They determine the broad policies which the rangers and technicians of the State Division of Forestry carry out.

Three board members represent the timber industry. Three members represent agriculture. Rosecrans represents the public at large.

The board meets at the state capitol in Sacramento. Off come coats, pipes are lighted, and discussion begins at about the level of the old-fashioned New England town meeting—a friendly give-and-take between the board members, lumbermen, cattlemen and farmers.

To carry out policies made cooperatively by the board and the timbermen, Governor Warren chose Gen. Warren T. Hannum, retired Army engineer, as director of the Department of Natural Resources. DeWitt ("Swede") Nelson, for 19 years a member of the U. S. Forest Service, was appointed state forester.

Since 1945, Rosecrans, Hannum and Nelson have teamed up with Governor Warren and the legislature to build a sound and workable forestry program. What they've done may point a way toward better utilization of forests and other natural resources—coal, petroleum, minerals, fish, soil—in other states.

These are the six Paul Bunyan steps taken in California:

1. Reorganization of the State Board of Forestry: Previously, members had been appointed by the governor and served at his whim. With each new administration, the board walked the political plank en masse. Today, by state law, a four-year term has been established. Terms are staggered to maintain continuity.

To supplement the state board and to provide the necessary "grass roots" contacts, four tim-

ber districts were created, according to the type of lumber produced. Four timbermen from each district, assisted by a forest technician from the State Division of Forestry, make up a district forest practice committee.

These advisory groups are supported to the hilt by the state board:

"You join us in making the rules," Rosecrans told them. "If two thirds of the ownership of the land approves by vote, and if we deem them adequate, we will declare them to have the force of law."

2. *Fire-fighting Responsibility:* There are eight forest-fire-fighting outfits in California—one state, one federal and six county. Before 1945 some borderline blazes actually destroyed valuable timberlands while the three agencies squabbled over who should put them out.

In 1945, however, the legislature authorized the State Board of Forestry to determine by survey the forest, watershed and range lands for which the State would assume the protection responsibility.

The State Division of Forestry acquired new fire trucks and bulldozers, initiated a state-wide short-wave radio system, added mountain lookout stations and acquired additional part-time help during the dry summer months.

It also concentrated on an educational program aimed at the 4,000,000 newcomers in California since 1940. A contest among school children produced the catchy slogan—"Keep California Green and Golden"—which is hammered home by radio, newspapers, billboards, magazine articles.

Last year fires on state-protected lands were 1,455 fewer than in 1947; 1,867 fewer than in 1946; and 2,163 fewer than in 1945.

3. *Forest Practices Act:* This Act put into operation the machinery for developing a code of rules to reduce waste and to insure a stable lumbering industry.

The cooperation of the lumbermen in this program, once it got rolling, was encouraging. When they realized that rules were designed by forest practice committees made up of private timber owners and operators and that they weren't being harassed by arbitrary and confusing laws, lumbermen often maintained higher standards than the rules required.

For example, in three districts rules require that trees less than 20 inches in diameter be left standing. Some operators today are not cutting trees less than 40 inches—figuring that this kind of long-range conservation will pay off in the future.

The Act has another feature which makes for peace and cooperation by the lumbermen: Forest practice rules designed by in-

dustry and approved by the Board set the tempo for all forest practices in the woods. The Board, however, is empowered to accept "alternate plans" if they promise equally good results.

The district committees and the state board also give consideration to "hardship cases." Say a small sawmill owner who has been in operation for ten years figures to shut down in about a year and a half. Under present laws it would cost him $10,000 to $15,000 to install a burner to dispose of sawmill waste.

His "alternate plan" is to clear the area 100 yards in all directions from the mill, install extra fire-fighting equipment, activate another pump to make additional water available. The owner saves a large chunk of money, the fire hazard is no greater and the state board gains another friend.

"We have made no great effort as yet to enforce the forest practice rules by court action," Rosecrans says. "We have depended almost entirely upon education, explanations and interviews. We are getting better than 80 per cent compliance now—and we think that is a pretty good start."

4. Forest Insect Control: For years the ravages of forest insects went unheeded so far as California was concerned. It was estimated that—from 1935 to 1945—insects destroyed enough pine timber alone to keep all of California's 900 sawmills working at top speed for one year. Today, with the passage of the Forest Insect Control Act, pest losses have been checked.

Under previous laws every timber owner had to be served—as in a lawsuit—so that his share of the expense could be collected or a lien filed against his property. Sometimes it required months to round up all absentee owners of small tracts. Meanwhile the insect menace continued to spread.

Now, when evidence of damaging insects is spotted, the area is immediately "defined and declared." Costs are allocated—on a 50-50 basis between the state and the timber owners—and the cash raised from the larger operators in the area. They don't mind paying for a few infested trees in small tracts whose owners can't be located.

"Through this kind of speedy action," Rosecrans points out, "we've checked the destructive pine beetle in California because we could get at it in a matter of days rather than months."

5. Forest Survey: In cooperation with the U. S. Forest Service, the State Division of Forestry in 1947 began an aerial survey of all timber lands in the state. More than $250,000 has been appropriated as the state's share of the work. It's a tremendous job in which aerial

photos are converted into maps showing types of timber stands, vegetation and soil conditions.

6. Range Improvement: Fire has done great damage to forest and watershed lands. Some of these blazes were set by stockmen who wanted to create better grazing land. The board recognizes that fire can be used as a tool to clear brush lands—if carefully controlled and if properly reseeded.

Since 1945 the state has developed a comprehensive range improvement program which has checked the rising number of incendiary fires in forest and brush areas.

Reseeding pays off. Last year in Tulare County, one rancher found that it took 80 acres of brush land to support one mature beef animal; after the lands were burned and reseeded, only four acres per animal were required.

Previously there had been serious conflicts between the forestry board and the livestock interests. Rosecrans decided to apply the same "grass roots" technique to this situation as he had done to the lumbering industry. Subsequently a 20 man range advisory committee was set up.

In the six-point program that has been followed since 1945, the University of California has played an important role. For the first time, the dean of the University's College of Forestry now sits as an ex-officio member at all meetings of the state board. Enrollment of students has been stepped up so that more than 200 young foresters, with degrees in forestry science, are now working for the State Division of Forestry and private lumbermen. A new $1,000,000 forestry building on the Berkeley campus was one of the first of the university's postwar buildings to be constructed. Soon to be built is a $670,000 forest products laboratory which will seek new uses for the 60 per cent of the tree that is wasted.

What is it costing California to solve a national problem at the state level? In 1944 the state budgeted an inadequate $1,500,000 for its forestry program. Today it spends $8,000,000 and the citizens consider it a sound investment.

Naturally, not all forest, range and watershed problems have been solved in California. But more sound forestry has been put into practice during the past five years than in the preceding 25 or 30. This has been due, largely, to Rosecrans' three-point method: 1. getting the cooperation of timber owners, cattlemen and sheepmen, 2. framing, with their help, flexible rules, and 3. administering them at the state level.

As the nation's No. 1 consumer of timber (560 board feet per capita as compared with a national average of about 275), California is using about 4,000,000,-

000 board feet a year. Its tree crop is increasing only at the rate of 1,500,000,000 board feet annually. Rosecrans thinks that under good management it can be increased to 3,500,000,000—more than double its present yield.

He's encouraged by such things as this:

Several years ago he was talking to a redwood mill owner in northern California who was cutting a 150,000 acre tract. He asked about future plans. The terse reply was:

"Cut out and get out."

A couple of years later, Rosecrans saw him again. The lumberman said:

"Bill, we've changed our minds. We're going to stay in the business. We may hit a flat spot in production about 35 years from now, but we believe there's a future in tree farming here in California."

He lit his pipe and added:

"I'm raising a boy. I want him to be in the lumber business when he's my age."

Home Grown Fence Posts

Home grown fence posts can supply a much needed farm item and yield a crop from small non-productive areas, says James W. Meteer, of the Department of Forestry at the Ohio Agricultural Experiment Station.

Black locust, when planted in odd corners and out of the way places around the farm, is a fast grower if the soil isn't too poor and it yields a surprisingly large crop in a few years time, Meteer continues.

An example of high yields to be realized was encountered this spring by Station foresters. Working with Stanley S. Locke, Regional Forester of the Soil Conservation Service, they had occasion to cut a small patch of locust on the Soil Conservation Service Hydrologic Experiment Station at Coshocton, Ohio.

Planted in the spring of 1938 on a rather steep, eroded hillside that had been abandoned farmland, the planting yielded 264 seven foot posts per acre. At a market price of $0.35 each, these posts from one acre are worth $92.40 to the farm. In addition, 50 smaller seven foot posts were cut, as well as 175 five foot posts suitable for electric fencing.

The foresters point out that the planting was cut at this time only because posts were needed on the farm and for experimental purposes.

—*Ohio Agricultural Experiment Station*

Steps in Dairy Herd Improvement

Condensed from Guernsey Breeders' Journal

Dr. H. A. Herman

Prof. of Dairying, University of Missouri

THE building and maintenance of a high producing, profitable, and eye-pleasing dairy herd is a common goal among pure bred and grade dairymen alike. Whether it is the large pure bred breeding herd, with its heavy investment in cattle, buildings, and equipment, or the little fellow on the side of the hill, with a dozen cows, a half dozen kids—and as many good fox hounds—the steps in herd improvement are almost identical. The fact that about 85 to 90 per cent of our dairy herds are under 12 cows must be recognized, as well as the fact that these small herds can and do often produce superior animals from a breeding standpoint. All too often we hear a small breeder complain that if he had the size herd and the money of "Mr. so and so" he'd really breed some good cattle; but it is doubtful. Then there is the dairy establishment, which by sheer weight of investment in land and buildings, a good group of assembled cows and often an outstanding sire, attracts much attention for a while. As the purchased cows (usually top animals) pass out of the assembled herd we often find the picture turning sour and the herd and its returns going down instead of up. It takes years of time, labor, and patience in addition to capital and good thinking to really do a first class job in breeding up a profitable dairy herd. The average tenure for the man who enters the breeding game with pure bred dairy cattle is about seven years. Not long enough to accomplish much, but time enough to really build in the right direction if we follow a sound plan—plenty of time, however, to become disillusioned and lose some money if we are thinking of a cinderella story.

Dairying is, perhaps, the most stable branch of agriculture we have. It conserves soil fertility; provides a market for roughages and homegrown grain crops; gives us a steady income, a year around job, and has less fluctuation in the price of its products than almost any agricultural commodity we could name. The factors for making a success as a pure bred breeder have become so well recognized that we can readily follow the guide posts if we so desire and are willing to pay the price

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in effort and good judgment. Dairy herds which succeed, return a labor profit sufficient to pay all costs of milk production, maintain building and farm lands devoted to their use, produce some surplus cattle for sale that command a fair price as breeding stock, and give the owner and his family a good standard of living. Herds which do this have very similar characteristics from the standpoint of the productive ability of the cattle, the managerial ability of the owner, and the type of farmstead he operates. The factors which enter into the picture for a successful program are usually:

1. *The owner has an objective.* The goal for which a man strives is important in any enterprise. For the pure bred breeder it means first of all that he must decide what level of production and what kind of a herd with respect to type and bloodlines he intends to have. Some goal is important even if it be only to have an average milk production of 8000 lbs. per cow on twice-a-day milking basis. Altogether, too many herds are failures because the owner is just milking and multiplying cattle. Therefore, sound practical ideas concerning production and type in cattle are a prime requisite for any aspiring breeder. No good architect would attempt to build a skyscraper without a fully detailed and complete set of plans at hand. Having these, he would proceed in an orderly way step by step to erect the structure of his vision. The building of a dairy herd through a breeding program is a matter of the same step by step process in selection and good management.

The breeder can influence the inherited characters of the animals in his herd only by the *practice of selection and mating* systems which tend to increase *desired characters.* Selection is one of the oldest and most valued breeding methods used. It is the only tool used by some breeders. There may be many degrees of selection in dairy cattle. Some breeders select only on such points as the individuality of the animal and its offspring, some only on the production of milk and butter fat, and others for fat test, etc. The majority of breeders, however, select and attempt to breed animals combining desirable productive ability and acceptable conformation.

2. *Establish a Breeding Program.* Dairy cattle from a genetic viewpoint are *heterozygous.* That is, the characteristics for production, type, reproduction, longevity, easy milking, disposition, etc., are variable from animal to animal. No two animals, with the possible exception of identical twins, are exactly alike. The production record of a cow, her conformation from a type standpoint, and the character of her offspring are our

only means of selection. The "Excellent" cow mated to an "Excellent" bull cannot be a sure fire method of getting an "Excellent" offspring. This is because all breeding is a sampling process and we have variations from many good to many bad points in the given progeny of any animal. However, if we select over a long enough period and allow only the better animals to reproduce, a herd can become remarkably uniform in its production and type levels. Therefore, a good breeding program calls for the location of desirable animals and their full utilization in a herd building program.

One of the first things for a breeder to do in planning a breeding program is to analyze his own herd carefully, directing particular attention to the herd sire in use and to those cows of desirable type that have not only demonstrated producing ability themselves, but have several offspring in the herd that have also demonstrated ability as producers. Almost every herd has a few cows, often in advanced age, that have produced consistently year after year and have also calved regularly, with the result that two and three generations are present in the herd. It is from these cows that a start in breeding may be made without going to the expense of buying new breeding stock.

The tremendous effect of the herd sire, good or bad, on herd development is appreciated by most breeders. An entire herd may be markedly changed within a few years in its course of development by the influence of a sire.

A good measure of a successful sire in a herd is his ability to sire daughters which produce more than their dams and are above the general herd average when handled under similar conditions. Breeding studies show that it is easy for a good sire to raise the production of daughters out of poor producing dams, but it is difficult to raise the production above the herd average, and more particularly above that of the high producing cows. It takes a truly great sire to raise the production levels in herds where the yearly average is between 400 and 600 pounds of butter fat. Where a sire has a group of daughters considerably higher in average production than the average production of the herd in which he is to be used, the chances are good that he will be able to favorably influence the future production of the herd.

The proved sire is the safest for insuring herd improvement, but unfortunately only a few such sires are available and many of these are too high in price for the breeder with a small herd. The breeder with a high producing herd, however, is justified in going to rather extreme measures to use only a sire of proved ability.

Where a proved sire is not available, the plan of selection found to be most unsatisfactory in the long run is as follows: First, select only a son of a good proved sire and out of a dam which not only has a good record herself, but has two or more production tested daughters that are of acceptable type. In selecting by pedigree, particular attention should be focused on the first three generations. The productive ability of *all the ancestors and all their offspring* should be carefully noted. Breeders should not be content to accept only a partial listing of the tested daughters of a sire or dam. It is much more assuring to know that a bull has a total of 20 daughters averaging 8000 lbs. of milk and 400 lbs. of butter fat at the average age of three years, than to be mislead by the partial statement that he had six Advanced Registry daughters averaging over 600 lbs. of butter fat as three-year-olds.

Likewise, if the dams have several tested daughters, preferably out of different sires, which are above the breed average, it enhances considerably the prospective chances of the young sire being a success.

In selecting a sire or females for breeding stock, it is advisable to inspect the sires and dams and if possible their grandparents and compare the relative merits of each from a type standpoint. Breeders who are attempting to correct such faults as weak udders, small teats, sloping rumps, etc., cannot expect to do this by simply using a bull with straight lines, unless he comes from a line of descendants particularly strong in the points needing improvement. All too often we find an outstanding animal from both type and production standpoint that comes from inferior ancestors. This does not mean that such an individual will transmit the desirable characters he exhibits; the chances are, since he is also carrying many undesirable characteristics, that these will be transmitted and disappointing offspring result.

In general, then, the process of improving a herd by breeding methods will come from the saving of offspring by a meritorious sire and from carefully selected dams whose ability as "brood cows" has been demonstrated through their offspring. Last but not least, all animals in a herd, even from the best sires and dams we can obtain, will not meet our expectations as producers or for type. Therefore, the successful breeder must continually cull the less desirable animals and keep only those which are desirable and, in addition, are proving their transmitting ability in the form of acceptable offspring.

3. *Test for production—Com-*

plete Herd Records. The successful operation of a breeding program depends upon complete and accurate records of milk and butter fat production, breeding efficiency, and progeny of each animal. Without records the breeder is at a loss in the intelligent culling of his herd. Therefore, the adoption of some form of production testing, namely, Dairy Herd Improvement Association, Herd Improvement Registry, or Advanced Registry, is of first importance. The keeping of milk and butter fat records permits the evaluation of sires upon the basis of their daughters' productive ability, thus providing a measure of the sire's transmitting ability.

Continuous testing and getting records on all of the daughters of a sire to be proved is vitally necessary for accurate evaluation of breeding worth. Students of breeding are fast becoming aware of the fact that basing estimates of transmitting ability on a few high records in a family is far less accurate than several records, or still better, lifetime averages, on every animal.

Progress in improving dairy cattle has been made since the beginning of D. H. I. A. testing in this country in 1906.

4. *Good Feeding.* An abundant feed supply is the basis for a good management program. Without adequate feed, dairy cattle cannot demonstrate their inherited ability. Likewise, heifers that are poorly grown never demonstrate the full measure of their inheritance as producers or from a type standpoint.

Feed costs comprise 50 to 55 per cent of the total cost of milk production. The first goal of a dairy farmer should be to produce feed! The feeding program provides the foundation for the breeding program. The dairy farmer who controls his feed costs is well on the way to success.

The use of good pasture, properly harvested hay, and silage are the keynote of this program. Contour farming, liming and fertilization to secure maximum yields of nutritious forage are essential practices to secure the best results and the successful breeder does not hesitate to adopt them.

5. *Disease Control.* Last, but not least, a breeder must have a disease-free herd in order that the results of the breeding program may be realized. Where Bang's disease, mastitis, etc., are prevalent in a herd, the improvement program is doomed to failure and it is best to clean up the herd and maintain it so before placing extended breeding plans in operation. Some of the evils of these above named diseases are: (a) Bang's disease results in large losses of calves and approximately 25 per cent reduction in milk and butter fat production; (b) masti-

tis results in approximately 22 to 25 per cent decrease in milk and fat production. Not only are cows affected with these diseases below par as producers, but often in the case of Bang's disease infections, prove to be shy breeders. (c) Breeding troubles such as Trichomoniasis, vaginitis, and occasionally Vibrio foetus can play havoc with a breeding program. Where a herd is built up from cattle bred on the farm there is less danger of introducing disease. Where purchases are made they should be from reliable parties and on the basis of clean health tests. Sires which have been used in other herds may well be used artifically to reduce the possible spread of breeding troubles.

6. *Convenient, Inexpensive Buildings—Labor Savings.* Good dairy buildings tend to create an environment which makes it easier to produce clean, wholesome milk, aids health control measures, saves labor, and makes both animals and man more comfortable. Building costs are high, but the "loafing barn" and milking parlor setup may be used satisfactorily and will help reduce building expenditures in many areas.

The dairy farmer can do much to reduce his labor expenditures by using such labor saving devices as milking machines, hot water heaters, manure spreaders, hay loaders, feed elevators, power grinders, automatic water heaters, tank floats, etc.

7. *Market Quality Products.* Knowledge of market demands and meeting them with respect to a timely supply of milk of high quality usually means the best income. Likewise, if surplus cattle are to be sold, a good job of selling may be done if the cattle are of good type, have production records, and are free of disease. It costs about as much to produce a "poor cow" as a top quality one.

The overall picture of the operations of a successful dairyman generally finds a proper balance of cattle numbers and feed supply available, good feeding and management, a good calf raising program, disease control, marketing of quality milk and cattle, participation in local, state, and national affairs affecting his breed and dairy program in general. When these goals are accomplished, the breeding of dairy cattle is a business with an entrancement all its own, and one which brings pleasure as well as profit to breeder and his family.

The Phosphate Story

Condensed from World Crops

D. P. Hopkins
B.Sc., F.R.I.C.

LIEBIG'S suggestion in 1840 that bone phosphate might be more readily effective as a source of plant food if pretreated with acid was put into successful practice with very little delay. Not only was Lawes's London factory producing superphosphate within a few years but he was easily able to sell all he could produce. The replacement of bone sources of raw phosphate with mineral phosphates was an early innovation. In short, the phosphatic fertiliser invaded 19th century agriculture very smoothly and speedily. It is now a century and a few years old and all through this period world tonnage of superphosphate has been expanding, rising sharply at times of high food demand, and rising or maintaining its current size even during periods of agricultural depression. There has been no sliding back.

Some 30 years after the introduction of superphosphate, new steel processes yielded a by-product slag containing the phosphatic impurities of iron ore. For a few years slag heaps piled up. Then it was thought worth while to test the fertiliser value of this waste material. It was soon found that 'basic slag,' if finely ground, was a slow but effective phosphate supplier. Here again there was rapid practical development from the moment of discovery.

The value of phosphatic fertilisers has been established by hard facts. Our detailed knowledge of phosphate action is however incomplete.

Many soils used in agriculture are markedly deficient in phosphate; yet they contain enough phosphate to support a series of crops. The explanation for this apparent paradox has long been known. A plant nutrient must first become dissolved in the soil solution and, out of the total phosphate in a soil, only a minute fraction is in the soil solution at any one time. However, as and when the plant removes phosphate, the soil solution's 'state of phosphate saturation' is reduced and it is able to dissolve more from the soil's reserve. What matters most, then, is not the momentary amount in the soil solution but the *rate* at which it is renewed. All experience shows that this rate is much below the rate at which

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phosphate is needed for good plant growth. The function of a phosphatic fertiliser is to add to the top soil supplies of phosphate which are able to pass fairly readily into the soil solution and thus augment the soil's rate of supply.

One of the biggest gaps in our knowledge is that we have never been able to isolate and identify the chemical forms in which phosphates exist in soils .They are rarely simple. Complex phosphates are built up, and these tend .to change from one to another; a change in the state of acidity of a soil will bring about changes in the phosphate complexes. Broadly speaking we can put these chemical forms into four groups:

(1) *Fairly readily available.* Calcium and magnesium compounds containing phosphate;

(2) *Fairly available.* Combinations of phosphatic material with organic matter.

(3) *Feebly available or non-available.* Compounds of iron and aluminium containing phosphate.

(4) *Unavailable.* Minerals of the apatite class, *i.e.* the rock-like minerals which must be long weathered before they can be regarded as true soil constituents.

A soil's available or potentially available phosphate consists of the first two groups. Its much larger locked-up reserves comprise the third group and perhaps the fourth. The phosphatic fertiliser industry's contribution is that it takes minerals of the fourth class from rock phosphate deposits and converts these into phosphates of the first group.

But complications begin to enter the story immediately the phosphate is added to the soil. Some of it may be quickly taken up by the growing plants, but some will react directly with soil chemicals, and the tendency of these reactions is to make the phosphate less available. The standard of efficiency of our major phosphatic fertilisers—in this sense—is very low. Of 100 lb. of soluble phosphate added to a soil, 25 lb. at the most may pass into the crop; the remaining 75 lb. is reverted to less available forms by soil 'fixation.'

Soils vary considerably in their fixing capacity and the rate at which they revert phosphates. An acid soil will have considerable amounts of iron and aluminium in its soil solution and when soluble phosphate is added to it, insoluble iron and aluminium phosphates are formed and a high proportion of the phosphate denied to the crop. On the other hand, fruited or alkaloid soils containing adequate free lime will precipitate calcium phosphates, which are

much more available. The effect of organic matter also cannot be ignored, and organic-phosphatic complexes may hold added phosphates in a form that is still potentially available to plants.

Two problems therefore arise, *viz.*: How far can fixation be reduced by attending to the soil condition and how far by improving the nature of the phosphatic material added?

The principal phosphatic fertiliser is superphosphate. Its manufacture is still essentially the same as first developed by Lawes. Insoluble mineral phosphate is ground and treated with sulphuric acid. Most of it is converted into mono-calcium phosphate which is water-soluble; some into di-calcium phosphate which is insoluble in water but soluble in very dilute acids; there may also be some unchanged insoluble phosphate. At first sight this might seem a phosphatic fertiliser of great efficiency. The soluble mono-calcium phosphate should enter the soil solution rapidly and from this plants should be able to assimilate their needs. But it is equally easy, or indeed easier, for soil materials to react with the phosphate in the soil solution. It is said to happen to so complete an extent that when superphosphate is left on the surface of soil, all the soluble phosphate has been 'fixed' by the time it has penetrated 1½ in. downwards. It is also said that the soluble phosphate in superphosphate has little or no direct feeding value to a plant; the phosphate that a plant derives from it comes indirectly from the products of its first soil reactions.

Nevertheless, it cannot be denied that superphosphate is an effective fertiliser, and the broad answer (or at any rate the theory most generally supported) is as follows. Except in the case of acid soils (when superphosphate is not very effective), soluble mono-calcium phosphate is precipitated as insoluble di- and tri-calcium phosphates. These precipitates are, however, of very fine particle size and distributed intimately throughout the zone of soil which the superphosphate penetrates. The soil solution, which is always slightly acid, can redissolve these slowly, and since they are not complex and expose (because of their fineness) a large surface area, they dissolve more readily than the phosphates in the soil's locked-up reserve. This has long been the orthodox reply to those who ask the question: Why go to all this trouble to make a phosphatic mineral water-soluble when it is known that the first thing the soil does to it is to make it insoluble again?

Nevertheless, it must be remembered that the larger part of this precipitated phosphate is *not* redissolved by the soil solution or, if it is, it is again precipitated. For

only 20 to 25% at the most is assimilated by the plant. It is this disturbing wastage that has led to widespread theoretical criticism of the superphosphate idea in recent years. Why not add a *non*-water-soluble form of phosphate to the soil and let this be slowly dissolved by the soil solution? Such, after all, is the mode of action of basic slag, or would seem to be; those last words must be added for we are not certain about the detailed reasons for basic slag's effectiveness.

There is, however, an empirical test for the value of non-water-soluble phosphates. Dilute solutions of citric acid or ammonium citrate are assumed to have about the same dissolving power as the average soil solution, an assumption which years of application in soil analysis have shown to be reasonably reliable. It has long been a controversy whether water-solubility or critic-solubility should be the criterion for the phosphate value of a fertiliser. In Britain and a minority of countries water-solubility is still the accepted standard, but in the United States, Canada, Sweden, France and other countries the official view is that water-solubility is of little or no extra value and that the citric acid or citrate-solubility is a sufficient indication of the availability of a phosphatic fertiliser. Lately, leading technical opinion in Britain has swung heavily against water-solubility, and many eminent soil scientists have suggested that Britain should abandon the water-soluble criterion in her future fertiliser legislation.

Progress has, however, been made in protecting water-soluble phosphate from soil fixation. Placing the fertiliser application in a row or strip is one protective device, and preparing the fertiliser in a granular form is another. Often the two methods are combined in practice. If a fertiliser is applied in a concentrated strip, its total surface of contact with the soil is much less than if the same amount is broadcast or harrowed in over a wider area. With less contact with the soil the rate of fixation is reduced. Placement positions have been found which enable the plant to obtain its nutrition quite as readily as if the fertiliser was generally distributed throughout the whole volume of soil around the roots. The principle underlying granulation is similar. One pound of superphosphate in granules of, say, 1 to 1.5 mm. diameter will expose much less surface area than 1 lb. of finely powdered superphosphate; each granule becomes the centre of a rich zone of steady phosphate supply, and plant roots actually concentrate themselves around these zones.

Tests with cereal crops have shown that placement can reduce the amount of superphosphate re-

quired by as much as 50%. It is difficult to decide whether the similar claims of granular superphosphate have been proved as definitely, for in most of the measured tests with this form of material placement has also been employed, and one cannot be certain whether the granular form or the placement has contributed most to the efficiency of the fertiliser dressing. It is not always possible, however, to adopt placement in applying fertilisers. In Britain and elsewhere the combine drill is the only general implemenet for placing a dressing, and the placement this drill provides is the row application of mixed seed and fertiliser. Unfortunately the seeds of some crops, *e.g.* roots, are damaged if they are combine-drilled, and even seeds that can tolerate intimate mixture with fertiliser can do so only if the rate of fertiliser application is below a very few hundred-weights per acre. It must be admitted, therefore, that placement has limitations as a method for generally reducing the extent of soil fixation suffered by soluble phosphate.

Can new fertilisers which resist fixation be produced? Before discussing this possibility we must consider another aspect that may be irrelevant in theory but is extremely relevant in practice. The war and the post-war period have brought new economic difficulties. For every ton of superphosphates produced, rather more than half a ton of sulphuric acid must be used. For most of its history superphosphate has been relatively cheap to produce because the acid used has been plentiful, but now, with some abruptness, this situation has changed and there are no longer big surpluses of sulphuric acid. Moreover, the production of sulphuric acid is rising only slightly each year, but there is a steadily rising demand for phosphatic fertilisers. French and Italian scientists have assayed the use of nitric acid for treating phosphate rock, but this method has the disadvantage of producing calcium nitrate as well as soluble phosphate, which is difficult to handle after exposure to damp air.

That is, therefore, another reason for seeking new phosphatic fertilisers. There are two, or perhaps three, objectives which must be kept in view:

(1) To obtain a material whose phosphate content is less subject to fixation;
(2) To produce an available phosphate from phosphate rock without using sulphuric acid; and
(3) For some countries, to find a process which will use readily obtainable and non-imported substances for the treatment of phosphate rock.

A new phosphatic fertiliser could

be successful if it fulfilled only one of these requirements; a fertiliser which satisfied all three may be too much to expect.

Some promising materials have already been developed, including fusion processes in which silica (with and without soda ash) is mixed with phosphate rock and, after high-temperature fusion, produces active phosphatic fertilisers. Towards the end of the recent war 'silico-phosphate' was made in a large-scale pilot plant in Kent; a somewhat similar product was manufactured on an experimental scale in East Africa. The fusion method is not entirely new, since it was developed in Germany during the first world war. The British silico-phosphate was about twice as concentrated as superphosphate and about three times as concentrated as average grades of basic slag. Tests showed that it was roughly as efficient as superphosphate (at the same rate of phosphate supply), while on acid soils a greater proportion of phosphate was taken up by the crop than was the case with superphosphate. Unfortunately, the Ministry of Supply's experimental production was only temporary and further results have not been obtained. It is beyond dispute, however, that the materials needed are cheaper than the sulphuric acid used in superphosphate manufacture, but the costs of high-temperature treatment and the wear and tear upon plant may more than counter-balance this initial advantage. Silico-phosphate does not contain any water-soluble phosphate and it falls in the citrate-soluble class.

Another line of approach is that developed by T. V. A. in the United States. This is based upon the conversion of phosphate rock into elementary phosphorus, a process requiring electric furnaces. Nearly 90% of the phosphorus in the mineral is extracted as phosphorus, which is subsequently burnt in oxygen or air to produce phosphoric oxide (P_2O_5), which on addition of water gives phosphoric acid. This acid is then used instead of sulphuric acid to treat phosphate rock, the resultant product being a very concentrated and mainly water-soluble phosphatic fertiliser, well known today as 'triple superphosphate.' A lesser-known T. V. A. fertiliser is calcium metaphosphate, which has been described as a kind of dehydrated triple superphosphate. In this process the vapour of phosphoric oxide, produced by burning elementary phosphorus, is allowed to act upon phosphate rock, the glassy material so produced being ground after cooling; the product, which is the 'metaphosphate,' is a very concentrated fertiliser. Both processes obviate the use of sulphuric acid and convert phosphate rock into an active fertiliser phosphate.

At one time it was believed that the T. V. A. methods were likely to remain unique. Cheap electric power seemed essential, and even then production costs were comparatively high. However, more concentrated products save bagging, transport and other handling costs, and where fertilisers have to be sent over long distances it is possible to offset higher production costs by economies in distribution. Triple superphosphate production will shortly commence in England. There is a great deficiency of phosphate in the soils of many of the tropical countries and it may be that this development will assist to meet the demand in the Colonial Dependencies. Proposals for the establishment of a plant for treating phosphate rock by this process are also stated to be under consideration in connection with the new hydro-electric power scheme which is being developed on Lake Victoria in Uganda. So far as concerns soil fixation it has not been shown that these new phosphatic fertilisers suffer less fixation than superphosphate, but they have proved themselves to be effective fertilisers by current standards.

It is probably true to say that new and fundamental research on the behaviour of phosphates (or phosphorus) in the soil is needed as a prelude to the development of fertilisers which do not lose so much of their available phosphate by fixation. The use of radioactive isotopes as a research weapon may open the way for progress. Indeed, this kind of investigation has already modified some of our older conceptions of phosphate uptake by plants. We can for the first time distinguish between the phosphate taken up from a fertiliser and that taken from the soil. It has been shown that in early growth wheat plants readily take up fertiliser phosphorus, but in their later stages they prefer to feed upon the soil's phosphorus. This must not hastily be regarded as a 'debunking' of the fertiliser idea. For the effect of the early intake of fertiliser phosphorus is that the plant is able later to take up more soil phosphorus than would be the case without the fertiliser phosphorus. At least this shows that we cannot hope to solve the phosphate problem by a chemical approach alone; the physiology of the plant must also be studied.

A very high rate of phosphate uptake (some two or three times as high as that of fertiliser practice) was achieved in some English experiments when cereal seeds were coated with a solution of phosphate and then dried. The limitation of this novel method would seem to be the very small amount of phosphate which can be supplied in this way.

In considering the wastage of

effort and material that is caused by fixation, it must not be forgotten that phosphorus is not merely a plant nutrient—it is also one of the most important mineral nutrients of man and animals. If we could ensure that 50% of the phosphorus we applied to soils passed into crops and thence into our foods, we should make an enormous stride, not merely in crop production but in human health as well, seeing that phosphorus malnutrition is much more prevalent than is generally supposed.

Wild Animals' Haunt Reclaimed for Cultivation

For long a preserve of the Meerut Tent Club for the holding of pig sticking competitions and a roaming ground for tigers and leopards, 22,000 acres of land in Ganga Khadir (Meerut district of the United Provinces) is being reclaimed for cultivation with the aid of tractors bought from the United States and Britain.

The reclamation operations started on December 17, 1947, and within a few months a buzzing colony sprang up on the site. Nearly 10,000 acres has so far been made fit for cultivation and laid out into ten square blocks of 1,000 acres each reached by roads.

In Naini Tal district, units of bulldozers and tractors are working in close proximity with prowling tigers and elephants. On several occasions the wild beasts came within a few yards of frightened operators and were driven away by armed guards on either side of the bulldozer. In this area, 60 tractors began work on January 4, 1948, and before the monsoon last year 7,500 acres had been made ready for ploughing. A crop was harvested last year and another of wheat and barley is standing.

The total acreage reclaimed last year was 28,000. The total production was 3,000 tons of paddy, 3,000 tons of sugar-cane and 4,300 tons of fodder. Another 40,000 acres is expected to be reclaimed before the next sowing season.

The Provincial Government has plans for reclaiming 800,000 acres by 1953–54, but much depends upon the supply of tractors bought out of a loan asked from the International Bank. If the loan is not granted, the Government will still carry out its plans, but their fulfillment may take 20 years.

—*Agricultural News Letter, Govt. of India Information Service.*

For A Better Pig Crop

Condensed from Successful Farming

E. L. Quaife
Iowa State College

MEETING the feed requirements of a pregnant sow is one of the most important phases of swine feeding, second only to that of the suckling period.

Every pig in a litter of 6 or 8 represents more than 100 pounds of feed at farrowing time. If he lives to weaning time at 8 weeks of age, he will represent more than 200 pounds of feed.

The kind of pig with which you have to work depends much upon how well you have fed the mother. The larger and stronger the pig at birth, the better his chance of survival. Statistics show that pigs weighing only 1½ pounds at birth have little chance to pull through. As the weight at birth increases, the death rate of newborn pigs is lowered.

Experience on farms shows there are a great many litters which are weak when farrowed. Or, there may be some half-grown, dead pigs in the litter, while others in the litter may be normal.

Diseases, such as "flu," striking your herd at breeding time or during the gestation period—or a touch of erysipelas—may in some instances cause such experiences. On the other hand, much experimental work at Midwest experiment stations has shown clearly that faulty feeding during the gestation (carrying) period can be the cause of such results. Rations made up largely of corn and not properly supplemented with proteins, vitamins, and minerals have definitely been to blame for litters of weak pigs and for unevenness of the litters.

Care and feeding before breeding time also may be a factor. Gilts having access to pasture during their growing period seem to have a "carryover" of essential vitamins into the gestation period. Therefore, compared with gilts raised in dry lot, they will do better on a gestation ration which may not be of the best.

It is widely known that sows farrowing in early winter months, such as January and February, usually have good litters. The theory behind this is that the sows bred in early fall have good pasture. And they benefit from the sunshine during two or three

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Des Moines, Iowa, January 1950

months while they are pregnant. All of this means that they go into the winter with a good storage of Vitamins A and D, which helps carry them through to farrowing.

Sows, and more particularly gilts, farrowing in late March and April have used up their store of essential vitamins long before farrowing time. As a rule, the greatest complaint from poor litters comes during March and April.

Poor results sometimes are seen in the fall litters. However, faulty nutrition is not so likely to be the cause as in the case of late spring litters.

Profiting from the practical experience of successful hog producers and the findings of state experiment stations, swine producers should be able to provide sow rations which will do the job.

Corn, the easiest to supply and the cheapest of the farm grains for the pregnant sow, may be the only grain or carbohydrate portion of the ration, if properly supplemented. *However, corn can prove disastrous when it is not properly balanced.*

Oats is available on most farms. As a rule, it is a more expensive hog feed than corn. But it has other values in the form of protein, minerals, and bulk, making oats a valuable addition to corn in making up the ration. Good-quality oats, weighing 35 pounds or more per bushel, might make up the only grain for old sows, although it would be too bulky for gilts. A combination of corn and oats forms the basis of a good sow ration.

Wheat in the wheat areas may replace all corn. Rye should not be fed to the pregnant sow because of the possibility of ergot in the grain, which might cause abortion.

A wide choice of good protein supplements is available to swine producers. There are many commercial-mixed supplements on the market which contain a variety of proteins, vitamins, and minerals.

Simple combinations or mixtures, made of one bag of meat scraps or tankage, a bag of soybean oil meal, a bag of linseed oil meal, and one of alfalfa meal, constitute a good supplement for pregnant sows. The proportions of these items might be varied, depending upon prices, but at least 20 percent of animal protein and 25 percent of alfalfa should be kept in the supplement.

What are good producers using? In 1947 and 1948, the 50 swine producers nominated in Iowa as Master Swine Producers marketed an average of 8.45 hogs per litter. Twenty-three of this group used various commercial mixtures, most of which averaged 40-percent protein.

Twenty-seven of the group mixed, or had mixed, their own supplement. They used mainly

meat scraps or tankage and soybean meal, with linseed meal used in some cases. Alfalfa was added to all of them.

Only four made use of skim milk. The results were comparable, whatever was used.

All these master producers know the importance of alfalfa. Alfalfa carries a fine quality of protein, but is valued most in the ration for its bulk, Vitamins A and D, and for its calcium content. Farm-grown, third cutting of good quality is tops for winter feeding.

Where a good grade of farm-grown alfalfa is not available, dehydrated alfalfa meal should be used. The content of Vitamin D in either form is variable. Therefore, it is advisable to add irradiated yeast to insure enough Vitamin D.

If the yeast is added to the ground grain, ¼ pound is recommended to the ton of grain. On the other hand, if added to the protein supplement, 1 pound is added to the ton of supplement.

A good grade of alfalfa may well make up 30 percent of the entire ration for gilts and as much as 40 to 50 percent of the ration for old sows. To get such a high rate of eating by the hogs, the meal would have to be mixed with ground grain.

No farm experience has been found as yet in the use of the Vitamin B_{12}—the animal protein factor—in brood-sow feeding. However, the farm practice of letting sows follow feeding cattle or work over the cow manure has always been a good one. In the light of the recent experimental work, there was more in the manure than the grain alone which accounted for the sows' doing so well.

Bran and middlings, while not high-protein feeds, add variety and improve most rations if small amounts are used.

Phosphorus from bonemeal, calcium from finely ground limestone, and sodium and chlorine in the form of salt are the major part of the necessary minerals in the pregnant sow's ration. In addition to these minerals, there are two trace minerals, iron and iodine, which should always be included in winter sow rations. The copperas (ferrous sulfate) prevents anemia, while the iodine is a preventive of goiter and a hairless condition in the newborn pig. Iodized salt may now be had and is the preferred way of feeding the iodine.

The above minerals in the amounts of 20 pounds iodized salt, 38 pounds finely ground limestone, 40 pounds bonemeal, and 2 pounds of copperas constitute what is called a simple mineral mixture.

Beyond the above-mentioned minerals, there are some other minor trace minerals, such as

cobalt, zinc, manganese, and copper, which are needed by livestock. There is little evidence that a good ration does not include enough of these trace minerals for swine feeding. However, trace mineral pre-mixes are on the market. They are inexpensive and, when added to a base of salt, limestone, and bonemeal, give positive insurance against the possible lack of such minerals.

The 50 Master Swine Producers previously mentioned made use of all kinds of mineral mixtures with about equal results. Of the 50, there were 27 who used commercial, complete-mineral mixtures, while 23 used the simple mixtures.

Minerals are generally self-fed. If mixed with the grain, 20 pounds to a ton of ground feed, or 60 pounds to a ton of the supplement, with minerals in addition, is recommended. If only vegetable proteins are used, 100 pounds might be added to a ton of the supplement.

There are different methods of feeding pregnant sows. Woodley Brothers of Wright County, who normally raise about 60 spring litters, let their sows follow feeding cattle. Les Woodley said:

"Our sows get plenty of exercise foraging for the grain in the manure. In addition to what the sows pick up, we self-feed in a feeder a mixture of 900 pounds of ground oats, 900 pounds of ground alfalfa, and 200 pounds of supplement, with minerals self-fed. About two weeks before farrowing we remove the sows to avoid possible injury."

The Woodleys saved nearly 8 pigs per sow in the Spring of 1949.

Donald Frakes, a Master Swine Producer in Wright County, uses a slightly different plan. He lets his sows forage for their corn in the field picked with a corn picker. Alongside the field is an alfalfa field in which the sows can run. In addition, he feeds 1 pound of protein supplement daily.

About six weeks before farrowing, he self-feeds in a feeder a mixture of 80 bushels of ground oats, 400 pounds of tankage, soybean meal, and linseed meal, plus 1,000 pounds of alfalfa meal and 250 pounds of minerals.

The condition of the sows probably can be controlled best by this method, and the amount of feed eaten by the sows may be a little less than if self-fed.

Another method followed by a good many producers is that of self-feeding a mixture of 900 pounds of ground oats, 900 pounds of ground alfalfa, and 200 pounds of supplement. The corn is fed in the ear form, preferably once a day in the evening. This method avoids grinding the corn.

Most producers will eliminate

most of the corn a few days prior to farrowing, but the sow should have all she wants to eat of the oats, alfalfa, and perhaps a little bran or middlings. Such feeds aid in prevention of constipation and help to avoid feverishness of the sow.

The Grass That Nobody Wanted

Condensed from California Farmer

Joseph Stocker

STUBBORN, ornery Bermuda grass, which farmers tried in vain to rout from their alfalfa fields until World War II suddenly produced a market for the seed, has proved a tidy bonanza to the arid areas of southwestern Arizona.

A relatively small region near Yuma produces approximately 98 per cent of the world's supply of Bermuda seed. There is some small production in California's Imperial Valley.

For many years the grass was only a nuisance. The farmers tried in every possible way to get rid of it. They plowed it up, treated it with chemicals and even went so far as to keep water off the land, hoping the tenacious grass would burn out under the hot sun. But it refused to die.

Then came the war and the growers received an urgent call for every pound of Bermuda seed they could produce, to provide sod for airstrips springing up all over the World.

Almost overnight the farmers reversed their strategy. Instead of trying to kill out the pest they brought all their ingenuity into play to step up production; putting nitrogen fertilizer on the grass and floating ammonia gas into the fields with the irrigation water.

The price soared as high as 70 cents a pound and production went up to about 1,500,000 pounds a year. Most of the seed was shipped overseas in waterproof bags—burlap with asphaltic paper lining.

Since then, other uses have developed. The Soil Conservation Service has bought large quantities of seed for erosion control, to stitch down denuded land with heavy grass mats. Bermuda has

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gained popularity as a pasture grass, supplanting clovers in many places, particularly through the South. It is being used to strengthen river levees and keep them from washing away. And, of course, the postwar housing boom has afforded a substantial outlet for the seed, for Bermuda makes an economical and hardy lawn in all but the far Northern States.

The fact that nearly all the world's Bermuda seed production is concentrated in this compact area is due apparently, to a peculiar combination of conditions: First, an abundance of sun. The Yuma region boasts approximately 85 per cent possible sunshine. Second, little rainfall only about 2½ inches a year. (A sudden rain striking Bermuda in bloom would destroy the seed crop.) Third, the variety's resistance to salt, which in recent years has been brought up with the well water because of declining underground water tables.

Many farmers mill and market their Bermuda through a cooperative, the Farmer's Seed Growers Association. They pool their seed and each gets his share of money according to the amount of seed brought in. They explain that this prevents any single grower from unloading his seed at a low price and thus upsetting the market. The co-op handled a quarter-million pounds of Bermuda last year, about 75 per cent of the Wellton-Mohawk output.

The co-op's processing plant, built during the war, consists of a clipper mill commonly used for rice, beans and grains. Through a combination of screening and blowing, the various seeds are separated and the hulls knocked off the Bermuda.

The seed also goes to the market in another form—unhulled. The hulled seed is ordinarily used in late planting and germinates in six to eight days. The regular form is used in early planting and germinates in 21 to 23 days.

This year's crop in the whole Yuma region promises to be the biggest ever—an estimated 2,000,000 pounds. The price has dropped off to about 40 cents because production is at a record high; Uncle Sam has gone out of the global airstrip business (for the time being, at least) and the postwar boom has subsided.

But the growers aren't worried about the future of their new industry. Erosion control, pastures, lawns for new homes, golf courses and other peacetime uses provide a reasonably stable market for Bermuda. Never again will it be the orphan grass that nobody wants.

Are Crossbred Cattle Better?

Condensed from Farm Journal

Claude Gifford and Ray Anderson

CROSSBRED beef cattle *can* make you more money than cattle of one breed—sometimes.

Eight years of cross-breeding trials at Miles City, Mont., show that. Compared with purebred Herefords, three different crosses gained faster, weighed more at weaning and market age, and graded higher.

What the Miles City cattlemen did was this: they bred some of their purebred Herefords to purebred Shorthorn bulls. The heifers from this cross were mated with purebred Aberdeen-Angus bulls; and the heifers from this cross were bred to purebred Hereford bulls. The three generations were tested two years and compared to purebred Herefords.

"All the bulls with known production records produced better crossbreds than they did purebreds," says Bradford Knapp Jr., who's been in charge of the work. "The crossbred females were good milkers and excellent range cows and mothers: the calves from the crossbreds benefited as much from that as from the fact they were crossbreds themselves."

But right now Miles City is trying another method. They're building up high-producing lines *within breeds.*

When these high-producing lines are developed, they can be mated with each other within the breed.

This new work is part of the National Beef Cattle Improvement Program set up by the USDA. More than thirty states are co-operating in the set-up. In the Miles City program—run cooperatively by the USDA and Montana State College—they already have nine lines of Herefords going. The first line crosses have been made, and the calves are now on the range.

How these linebreds will compare with crossbreds remains to be seen. Right now, it appears that crossing lines *within* breeds won't give as much "kick" as crossing these same outstanding lines *between* breeds. But they'll know more about that later.

Meantime, the cross-breeding results are worth any cattleman's attention. (For a detailed account write for USDA's new circular No. 810.) Briefly, here's how the crossbreds outdid the purebreds:

The first generation (½ Here-

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ford, ½ Shorthorn) weighed more all along, gained faster, and got more from their feed. The second generation (½ Angus, ¼ Shorthorn, ¼ Hereford) weighed more, graded 1/3 to ½ grade higher, sold for a higher price, and returned a net of $11 and $14 more per head the two years. The third generation (⅝ Hereford, ¼ Angus, ⅛ Shorthorn) weighed 60 to 100 pounds more at weaning and 105 to 135 pounds more at market time the two years. They graded higher and returned a net of $21 and $35 more per head.

The crossbred cows also raised more calves than the purebreds.

However, there are three things to consider before you go into the crossbred business:

1. Be sure your cows are fenced in so they get bred by the right bull.

2. If you sell feeders, establish direct contact with the buyer, and let him know their background. Crossbreds usually bring less on the open market than feeders of uniform color. (If you're the buyer, it's just as important for you to know the ranchman and his cattle. If you raise your own calves, of course, there's no problem.)

3. There's not so much danger of the price being knocked down on the fat market. But if you feed crossbreds, it's still a good idea for you to know your cattle buyer—and for him to know you.

If these conditions can be met, cross-breeding may mean extra money to you. Otherwise it may not.

When the results of the new line-breeding program are ready, we'll know better how it compares with crossing breeds, and just where each one fits in.

Agricultural Progress in India

Nearly 5,000 Mysore University students will spend their summer vacations building or repairing roads, cleaning streets, digging pits for compost making and teaching the three R's to village people.

The Mysore state spends one-fourth of its total revenue on education. In 1947–48, nearly 4,450 new schools were opened and nearly 9,000 adults were taught reading and writing.

—India News Bulletin

Problems in Farm Flock Production

Condensed from Sheep & Goat Raiser

J. L. Horlacher
University of Kentucky

For the first time in many years there is increasing interest in establishing and enlarging commercial flocks of sheep for the production of spring lambs. The relatively high price of fat lambs is proving attractive to men who have land adapted to farm flock production. The difficulty is that there seems to be scarcity of both breeding ewes and registered rams of the proper type and quality. The reduction in purebred flocks which began during the war and has continued since the war makes good rams hard to find. As a result, prices this year have been in the upper brackets and the demand is great.

The sheepman who is increasing his flock or the man who is just beginning can lay a good foundation for future profit by careful selection of the foundation ewes. Young ewes are best, preferably well-grown yearlings. Sometimes it is dangerous to select older ewes. They may be somebody's culls and for some reason they have been unprofitable. This is the reason they are for sale. Young ewes from the west are most in demand.

Milk production in ewes is important. Experiments conducted at various experiment stations show that the rate of growth of a lamb is in direct proportion to the amount of milk the lamb gets from its mother each day. In other words, more milk means more pounds of lamb in a shorter time. One of the most successful lamb producers in Central Kentucky marks his lambs to indicate the month in which they are born. January lambs are marked with blue paint, February lambs have the red mark and March lambs are marked black. In May the first lambs are pulled out for market and they are from the blue group. Not all of them are ready to go, however, and must be left for later finish. In June, most of the lambs marketed are from the red group, but still not all of the blues are ready. What is the reason for this? The best explanation seems to be that the dams of these late blue lambs are poor milkers. In fact, on examination it is found that some of them have practically ceased to produce milk, even as early as May. The question is what is the normal length of lacta-

Reprinted by permission from Sheep & Goat Raiser
San Angelo, Texas, December 1949

tion in ewes under Kentucky conditions. The experiment station has not yet answered this question.

If it is definitely known that certain ewes are poor milkers, then the solution is to creep feed the lambs. This is not a common practice, but experiments show that creep fed lambs will be ready for market from two to three weeks earlier than lambs that are not creep fed, if milk and grass are in short supply.

Another factor to be considered is that the ewe that lambs in April the first year will probably do it again. In other words, the time of the first lambing is an important indicator of the future performance of the ewe. The same thing is true of the amount of milk produced and the weight of the fleece. Under present conditions it may be necessary to keep these late lambers in the flock but when ewes become more plentiful good sheep husbandry would indicate that these ewes should be culled.

Early lambing pays dividends in increased price per pound. Referring again to this same Kentucky sheepman, he sold the lambs from the January lambing on May 11 at 34 cents per pound and an average weight of 82 pounds per head. The February lambs were sold June 25 for 28 cents at about the same average weight. The March lambs were sold early in August at 26 cents per pound and they weighed less than 80 pounds. What better evidence could there be in favor of early lambing and good milk production than the figures quoted?

Long-aged yearling ewes brought in from the west are most popular and seem to give most satisfactory results. They are hardy and are relatively free from internal parasites. They adapt themselves readily to conditions in this section of the country and are ready to go into the breeding flock in August or September. They ship well and soon recover the shrink due to shipping. Because of the scarcity of good yearlings, the custom has grown up of buying ewe lambs, wintering them, and selling them as yearlings the following year. The fleece pays the wintering cost and the increase in value over cost represents profit. Ewes handled in this manner are quite successful in the commercial flock. A third plan is to buy long-aged, well-grown ewe lambs and breed them in the fall. From this system a lamb crop of 60 to 80 per cent can be expected. Sometimes, however, the ewes which are bred as lambs skip as yearlings. The initial cost is lower, but the returns the first year are also lower. It is probable that the net profit would be about the same, though we have no definite figures on that.

Because of the many problems involved it would be desirable to

conduct an experiment designed to give specific data on various kinds of ewes. This experiment should include long-aged yearling ewes brought from the range as yearlings, yearling ewes brought in as lambs and wintered in the farm flock area, and ewe lambs. The findings of this experiment would be most valuable to lamb producers and would help them plan their breeding operations so as to make possible the greatest profit.

Hereford cattle breeders are sponsoring research at certain experiment stations designed to determine whether the most profitable feed-lot calves are sired by large, medium-sized, or small bulls. It seems that this experiment was inspired by the tendency of certain breeders to produce the pony type of calf for show purposes, without too much attention to profitable gains in the feedlot. Perhaps there is room for research of this kind with reference to ewes and rams. Some years ago the Montana station determined that the rate of growth and the final weight of lambs is in almost direct proportion to the size of the ewes. In other words, larger ewes produce larger lambs that reach market weight at an earlier age. In general, sheepmen in the farm flock states believe that best lambs can be produced from large, capacious ewes and smaller, quality rams. Market grades of lambs so produced frequently bear out this belief. However, many favor larger lambs which can be produced by the use of rams of the larger breeds. When there is no premium paid for quality, as has been the case in recent years, the men of the second group have a strong talking point. It must be evident that unless maximum pounds of lamb are produced, maximum gross income cannot be realized.

Scientist-'Farmer'

Condensed from The Harvard Foundation News

IN THE red-lit gloom of his "tropic clime" laboratory at Cambridge, a Harvard scientist has been growing "crops"—40 peas and a handful of oats at a time—in a patient, 10-year project that has become an attack on cancer through study of growth.

The persistent "farmer", whose peas live out their lives in eight days and whose oats' life span is even shorter, is Dr. Kenneth Vivian Thimann, Professor of Biology, Director of the Harvard Biological Laboratories and co-discoverer of the sensational plant growth hormone (auxin).

Until recent years, attempts to fight cancer centered on the study of cancer itself—the tumors in the human body. Now it is realized that cancer is growth—abnormal cell growth—and that growth, as growth, should be studied.

One of the major attacks has been in the study of botanical growth. In plants, it is known that growth can be controlled by simple solutions which can be man-manipulated. The growing is done in virtual darkness, so the scientist can study the nutrient. The plant is kept out of the sun, which would induce synthesis. The only nutrients added are added by the scientist.

Day after day, year after year, by the red glow of the dim lamps, Dr. Thimann plants his crops in a room with humidity constant at 85% and temperature always 78 degrees. Each time, he lays out about 40 peas on a perforated glass tray, which is partly immersed in water.

In the moist and sticky climate with conditions uniform for all the peas, each one sends out an inch-long sprout within four hours. After seven days, the sprouts stand about eight inches high.

With a pair of razor blades set 20 mm. apart the scientist cuts off 20 mm. of stem. He puts this fragment in another solution, then measures its growth. He poisons the solution, enriches it and otherwise manipulates the growth of the plant fragment, which looks like a pale piece of pencil lead. In a day or so, the peas have served their time. Other batches are on the way and the process is repeated. This has been going on for a decade.

Alongside the professor's pea crops, handfuls of oat kernels,

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Cambridge, Mass., May 1949

after being laid out for hours on moist filter paper, are similarly grown in simple solution. Wrapped like tiny umbrellas in the oat sprout are paper-thin leaves, which are removed from an outer sheath. This time only three mm. of the outer sheath is cut off, slid onto the tooth of a comb to hold it straight, then put to soak and observed.

In another phase of the growth study, a plant fragment is placed in a small glass receptacle, with a cup of alkali in the center to catch CO_2. This is immersed with an attached thermometer in a vat of water held at constant temperature. The instrument records the respiration of the tiny plant fragment!

"A plant must breathe to grow," the professor explains, "but it does not have to grow to breathe. Its growing may be accelerated without corresponding speedup of respiration. Growth and breathing are like two wheels that tend to rotate with each other but are not geared in any known ratio."

Whether or not his research may lead to the defeat of cancer, Dr. Thimann's plant growth studies already have proved to be a tremendous boon to food production for the world. The growth hormone, of which he was co-discoverer in 1935, enables nurserymen to reproduce their plants by growing them from cuttings. It is being used in spraying apple trees to keep the apples from falling off before they are thoroughly ripe.

More spectacularly, the auxin appears as a weed-killer. Used in excess, the growth hormone actually kills plant growth. Now being produced by the ton as "2,4-D", it can be strewn freely on lawns and on cereal crops. Happily, it does not affect the growth of grass plants but does destroy the weeds.

"Canned" Milk

Condensed from New Jersey Farm and Garden

William A. Haffert, Jr.

IN INDIANA, two veteran dairymen have invented a new canning process whereby milk can be kept fresh for months without refrigeration. It is not condensed milk. It is not powdered milk. It is not frozen milk. It is fresh milk—so fresh that the average person, blindfolded, will call it fresher than bottled milk, even when it is served after being stored at room temperature for nine weeks or more.

Dr. Roy Graves, and John Stambaugh invented the process at Wood-Jon Farms, a Holstein breeding plant, in Valparaiso, Indiana—about 30 miles this side of Chicago.

The canning process begins when milk passes from the milking machine into a receiving tank in the central part of the barn. It is repumped into a homogenizer, then through a special pasteurizer and into a filling tank. The pasteurizing unit has a steam-heated grooved core around which the milk circulates at great speed. At 270 degrees, the milk is pasteurized in 20 seconds. From the filling tank, the milk is injected into the can through a special device filled with nitrogen to keep out all air.

Previous attempts to can fresh milk have failed because the equipment was not sufficiently airtight. Airborne bacteria multiplied and turned the milk sour inside the cans. The new method, which is airtight from cow to container, actually makes the milk more easily digestible than ordinary pasteurized milk. It retains its original vitamin C content at nearly full strength for weeks after it is canned. Bottled milk loses it after only 48 hours.

It will be some time before consumers and producers will be using the process, since it must be scaled to large-volume production. One large dairy manufacturer already has built an experimental milking system, however.

Every dairyman need not have a pasteurizing and can-filling device. If he collects milk in airtight containers and gets them to a central plant within three hours, he can become a supplier. It may require a "milking parlor," however.

Dr. Graves states that:

It requires a cleaner, fresher

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Sea Isle City, N. J., January 1950

milk for canning than is required for the "Grade A" market. This milk must be kept away from contact with air; it must be delivered to the central processing plant within three hours of the completion of the milking of a herd; it must be drawn from the cow into a glass weigh-jar where observation of any tint of blood can be made; it should be kept near body temperature until processed; and, of course, the teats must be clean of any foreign material when the teat cups are placed on them.

We have designed a milking parlor and equipment that makes these steps easy for the operator. To our mind it means that cows must be milked in a "milking parlor." The cost of building a milking parlor will vary in many areas.

Unfortunately, the cost of the milking parlor and stalls and milking equipment will not vary greatly with the size of the herd. Probably the herd should be as large as 40 cows to justify this expense. However, the man who builds and equips a milking parlor for a smaller herd can greatly expand the size of his herd without adding to the size of the parlor, or increasing the number of milking units. Then, too, a uniform price for his milk throughout the year will aid him materially in retiring the cost of this investment.

With the modern milking parlor, one man, with the help of some member of his family to drive the cows to and from the stalls at milking time, can easily milk and care for the equipment for a 50-cow herd. A definite figure cannot be given on the cost of a four-stall milking parlor fully equipped with stalls and milking equipment, because of the variation in building costs in different areas, but we believe it will be approximately $5,000.

If you could read my correspondence, you would realize, as I have come to realize, that it will take some time for the supply of canned milk to reach the point where it can meet the needs of people in communities that do not have adequate amounts of good milk. These letters are coming from many parts of the United States, from Alaska, from the islands in the Pacific, from Mexico, from the Caribbean Islands, from the Central and South American countries.

One man said to me recently, "Think what it will mean in . . . where surveys show a widespread incidence of tuberculosis in children, but where they can do little about it because of the absence of an adequate nutritional diet to combat the infection."

Too Much Nitrogen Or Not Enough Else?

Condensed from National Live Stock Producer

Dr. William A. Albrecht
Chairman, Dept. of Soils, University of Missouri

THAT plants may go on a "nitrogen jag" has long been pointed out by the grazing cow when she lets the rich green spots of grass grow taller while she grazes the short grass all around them even shorter. These spots mark the liberal doses of nitrogen in her droppings that result in a luscious, massive growth. But the cow says, "No, thanks, I don't care for it."

She can balance the protein and carbohydrate in her diet as she grazes selectively the different kinds of plants in the mixed herbage of her pasture, or the same plants over different soil areas. That is why she leaves more white clover but less bluegrass. That is why, by June, the pasture is mainly white clover and the horses get the "slobbers."

Those deep-green grass spots, fertilized by much nitrogen applied through her droppings, do not appeal to her as possible of providing a balanced diet perhaps, and so she by-passes them. At any rate her body physiology directs her appetite to balance her ration. The excess of nitrogen represents an unbalance to her, and she says so by refusal.

"Too much is too much" only in relation to something else. If too much nitrogen is used in relation to the supply of phosphate, potash, calcium or other growth factors, the unbalanced situation causes trouble. It is the lack of balance in plant nutrition that is disturbing. This is merely saying that there is too much of some, or not enough of some other nutrients. That is the way it must be said when the absolute amount of each nutrient needed for each particular function is not yet known. We do know, however, that when an adequate amount of nitrogen is available, and other necessary factors are adequate, then growth and yield can be truly spectacular.

That animals do instinctively select food which provides a balanced ration was suggested by some work by Dr. George E. Smith. In this test, rabbits were fed grasses grown on soil that had been treated only with nitrogen. This work was a part of the studies leading to the bio-assay of

soil fertility, by using the animal to measure the value of soil treatments rather than a mere increase of yield in bulk.

Nitrogen fertilizer on the grass, it was true, made a large and luscious green growth that would seem a great tempter—if only the human eye judged it. It appeared equally significant as a means of growing more grass per acre—if just the growing of more grass were the most valuable part of our efforts to improve pasture production.

But the rabbits, when fed the grasses from areas with different soil treatments, had their own criteria for judging the resulting food values. The seemingly beautiful green, nicely cured grass hay from the plots where nitrogen alone was used was not taken eagerly. It was consumed only as a partial defense against starvation and it did not keep the rabbits from getting dangerously close to that before their death was prevented by shifting the ration. Other rabbits given grass hay from plots that had no soil treatment maintained themselves, consuming the ration more completely.

In dealing with a ration of fertility elements for plants, we too commonly consider the plant ration as merely the sum of the separate items. We think of calcium, plus nitrogen, plus phosphorus, plus each of all the others necessary. These are taken into the plant and eventually delivered through it to the manger and thereby to the animal for its use. Through chemical analysis of plants—after we have burned off the carbon, hydrogen, oxygen and other contributions of weather origin—we believe that soil fertility is a collection of some 10 or more elements taken from the soil for the use of animal and human bodies.

This concept suggests that, if that is all we need to do, we might just as well use a shovel and truck to haul calcium as limestone from the crusher to the mineral box. As a curative help to an animal already in disaster this may have some value. It illustrates the widespread failure to appreciate that plant nutrition is not as simple as limestone, plus phosphate, plus potash plus any other thing in any amount merely dumped on the soil to produce crops to haul to the feeding rack.

An important matter in plant nutrition is the fact that plants must eat where they are. Unlike the cow, they can't pass up the place where there is too much nitrogen or, rather in the converse, where there is not enough of nutrient elements of distinctly mineral origin to better balance the nitrogen in their ration. Consequently, they run their manufacturing business of synthesizing the fertility of the soil into or-

ganic combinations by means of air and water the best they can.

If there is much nitrogen, they weave this into chemical combinations with carbon, hydrogen, etc. that builds a lot of green vegetable bulk that may not keep the plant from lodging and may not result in seed to keep the species multiplying. Plants must weave as the woof and warp permit. But the plant is doing as the conditions demand, whether we call it too much of some or not enough of others.

Root growth suggests that plants do make some selective searches through the soil. This is indicated when we find more roots around decaying organic matter, a piece of limestone, a granule of phosphate or see the high concentration of roots in a fertilized portion or band in the soil. It is by such cafeteria-like "browsing" through the soil by the roots that the plant top is the final blending of fertility elements into the compounds that are built in a major way by photosynthesis. It is this soil fertility that makes the plant more than just sugars or starches—a contribution of sunshine power and the weather.

It is this synthetic performance, controlled and determined by soil fertility, that results in plants of nutritive value for growing bodies which does something more than just fatten them with such energy foods as sugar and starch. Plant growth is a synthetic performance using soil and water, and not merely an addition or collection of these fragments into a common mixed lot.

Here then is the idea of a balance, or the proper amount of each element of soil fertility—nitrogen, phosphorus, calcium, etc.—in relation to each of the others. It is a matter of not too much, or of not enough, of any one in relation to the others that are needed by the plant. We must not forget that if there is too much of one for a certain synthetic performance, the plant may indulge in performing another way.

A plant's functions are not confined to the use of only one recipe. When carbon, hydrogen, oxygen and nitrogen are involved, there are infinite kinds of chemical linkages and it is these—different amino acids for protein or pseudoproteins and different kinds of carbohydrates—that the cow is trying to help us appreciate as she selects her grazing according to the differences in soil fertility.

Too much nitrogen, or not enough else you say? Yes, as long as we are not as well informed about differences in synthetic output by our crops for nutritive values as, we must finally admit, the cow, the chicken or even the hog are, then after all, it is a matter of proper balance or of being moderate in all things.

Farming on the Aran Islands

Condensed from Rural New Yorker

Earl M. Benson

IF AT times you are inclined to be discontented with your farm and complain of the poor returns from your acres, you should spend a few days on the Aran Islands 30 miles west of Galway off the coast of Ireland. Here you will find a people waging an incessant struggle to gain a subsistence, and often only a bare existence from the barren land and the rough seas.

These islands — Inishmore, called the big island, with an area of 7,760 acres, Inishmaan with 2,349 acres, and Inisheer with 1,448 acres—have a population of only 1,975. The inhabitants depend on fishing and agriculture for a livelihood. In spite of the fact that over one third of the surface of the islands is barren limestone, the people raise surprisingly fine crops. There is some arable land which consists mostly of sandy loam. This, however, is very shallow but, because of the large lime content, the grass is excellent and cattle and sheep thrive on it. In fact, cattle raised on the Arans bring much higher prices in the Galway market than those raised on the mainland in Connemara where the soil is peaty.

The bulk of the crops in the Aran Islands is grown on land that has been made by the islanders. A level space of barren rock is selected and all crevices are carefully filled with broken stones to prevent the soil from disappearing. Then alternate layers of seaweed and sand are spread on the rock. All of this has to be brought from the seashore, some of it in baskets or sacks slung across the backs of donkeys, but in many cases it is carried up by the men and women. To this is added any litter that can be scraped up along the roads — the droppings of horses, donkeys and sheep. Practically all 'made' land is composed of sand, seaweed and this litter. Natural soil does exist in some pasture land where pockets of soil are found. This is caused by decomposition of vegetable matter lodged in crevices of rocks and forms small grazing areas for cattle and sheep.

Some of these built-up fields are centuries old having been handed down from father to son for gen-

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333 West 30th St., New York City, N. Y.

erations. You never see a "for sale" sign on any of these fields, because they are priceless. The government has recognized the need for more arable land on these islands and now pays a substantial grant per acre to the owners for this work.

Each field is enclosed by a crude stone wall about five feet high to keep the soil from being washed or blown away in a severe storm. Strangely enough, there are no gates in these walls. One day I rode down to the western end of the island with Pat Mullen, who was very helpful to Robert Flaherty when he was producing his wonderful film, "Man of Aran." We went out to the small pasture where his horse and sheep were grazing. Pat vaulted over his stone wall and put a halter on the horse. Then, to my amazement, he quickly removed a section of the wall to within a foot of the ground, passed the halter rope over to me and asked me to lead out the horse. I volunteered to help put back the stones, but Pat shook his head, telling me that there was a knack in doing this. Every stone had its place and, if they were not properly laid, all the sheep would soon be out in the road. According to Pat, there is no wood to spare for gates because the only trees on the island are four acres of dwarf ash near Kilronan, the largest village of some 300 inhabitants. Quantities of driftwood are washed ashore but this is heavy timber from shipwrecked vessels, and unsuitable for building purposes.

The most important crop is potatoes. They are planted in ridges, which, including the furrow, are about three feet wide. After the ridge is covered with seaweed and whatever farmyard manure they may have, the seed is dropped and covered with soil from the furrow. The best farmers later help along the crop with a dressing of commercial fertilizer. Usually the plants are sprayed several times to prevent blight. The favorite variety is called 'up-to-date' which looks much like our Green Mountain variety. In a favorable season yields as large as 20 tons per acre have been obtained; the average yield, however, is about 12 tons. This is not only a very important food supply of the islanders, but it is used for feeding cattle and pigs. From 500 to 1,000 tons are also exported to the mainland each year. Farmers are supplied with certified seed at a reduced price by the Department of Agriculture.

Next in importance is oats. A trench six inches deep is dug with a spade; modern farm implements do not exist on the Arans. The seed is then scattered by hand and covered by dragging brush back and forth over the row. The crop is harvested with a reaping hook and threshed by striking the

sheaves against a large rock. The grain is winnowed on a windy day by pouring it from a bucket on a piece of canvas spread on the ground.

The only other grain crop raised is rye which is cultivated and harvested by the same method. The straw is used for thatching the cottages. On several cottages I saw a fair crop of rye growing out of thatch, a matter which did not seem to trouble the farmer. Beets, turnips, cabbages and onions are the only vegetables grown.

All cattle are of the Shorthorn type. They are well conditioned and of excellent quality. They are not housed, even in Winter, as the climate is very mild and snow and frost are rare, thanks to the warm current of the Gulf Stream. The rainfall is much less than on the mainland and a very dry season is sometimes fatal to crops because, with the soil of such shallow depth, they suffer from lack of moisture.

The small land owner usually keeps a cow, a calf, a yearling, four breeding ewes, a donkey, two pigs, and from 10 to 20 hens. Most of the larger farms have a horse of a small Irish draught breed of an average height of 14 hands. After the sheep are sheared, the wool is sent to Galway to be carded and spun. The island women then weave it into a special pattern tweed and make it into clothing. It is a very serviceable cloth and rainproof because the natural oils have not been removed. The yarns are dyed in many colors with homemade dyes prepared by boiling local plants and varieties of seaweed.

The islanders depend largely upon fishing for their cash income and much of their food. Herring and mackerel are caught in nets and bring good prices in the Galway market. Much of their catch is sold to buyers who come in luggers to the islands. The fishermen also dry herring and mackerel for their own use, fastening it to the thatch of their cottage to keep it out of the reach of dogs. Plaice, similar to the American flounder, and black sole, another species of flat fish, provide them with an abundance of fresh food. The black sole is considered in Ireland as the best sea food available and there is always a good market for it.

The fishermen use the same type of boat for fishing that has been in use for generations, the curragh. This is a long, staunch, round bottomed boat of heavy canvas stretched over the ribs and covered with a protective coating of tar. It is about twice the length of a dory and will accommodate three oarsmen.

On account of the scarcity of wood, the only fuel of the islanders is peat which has to be imported

from Connemara on the mainland. Every cottage requires about 30 tons of peat each year.

Those interested in life on the Arans will enjoy reading Synge's "The Aran Islands," and Pat Mullen's "Man of Aran" and "Hero Breed." Mullen's books give a very intimate picture of the people on these isolated islands who struggle to gain a livelihood from land and sea but have a welcome for any who may visit them.

The derivation of the name "Aran" is clouded by the shadows of the past. According to Muirhead's "Guide to Ireland":

"Ara Naoimh, 'Ara of the Saints', owes its name to St. Edna, who obtained a grant of the archipelago from Aengus, King of Munster in the fifth century, evangelised the inhabitants (who were perhaps descendants of the Firbolg) and founded ten convents. Numbers of holy and learned men were attracted to the islands and the convents increased and flourished while the O'Briens and O'Flaherties were disputing possession of the land. In 1587 the English mastered the O'Flaherties and the monks were dispersed, and after 1651 the castle of Arkyn, fortified by Clanricarde, held out for a year after the surrender of Galway. When it fell, the Cromwellian soldiers demolished the church of St. Edna to construct a strong fort, which was garrisoned for many years after the second capture of Galway in 1691."

In a guide to Ireland issued by the Cliodhna Press of Dublin, it is stated that the derivation of the name "Aran" is somewhat disputed. It may have come from the Irish word "Ara," meaning kidney; support being lent to this claim by the shape of the largest island, Inishmore.

Maclennan's etymological dictionary of the Gaelic language gives the meaning of Aran as "bread," "livelihood." Dineen's Irish-English dictionary gives "bread", "loaf", "subsistence", "employment." There is therefore equally good reason to conjecture that the islands got their name from the fact that they suggest the shape of loaves of bread as one looks at them from a distance.

New Drug For Mastitis Control

Condensed from American Agriculturist

WHILE less spectacular than diseases which cause sudden death, mastitis, in the minds of most dairymen, is now Public Enemy No. 1 to dairy cattle.

It is unlikely that science will ever discover a remedy which will be a cure-all for mastitis and which will remove all the dairyman's worry about this disease. There is a reason for that statement, namely, that even though a cow suffering from mastitis may be completely cured, there is always a probability that she will become reinfected.

Therefore, it will always be necessary for dairymen to guard against this disease, to consider it a herd problem rather than an individual cow problem, to have periodic tests made to detect mild cases, and to observe good barn and milking management.

For some years scientists have been searching for a drug that would cure mastitis, and have been testing a number of newer drugs which gave promise. The very newest which is just on the market is called Aureomycin. It was discovered by Dr. B. M. Duggar who, when he retired from the faculty of the University of Wisconsin at the age of 70, joined the staff of Lederle Laboratories of Pearl River, New York. Aureomycin is a product of a mold and was discovered in a sample of soil taken in Illinois, one of 900 soil samples which Dr. Duggar had collected from many parts of the world.

Extensive trials were made before aureomycin was offered to dairymen. Among the claims made for it are that it kills a larger variety of organisms than are killed by other remedies tried, and that, applied through the teat canal, it penetrates to a wider range of udder tissue. The reason given for this fact is that the aureomycin is prepared in an ointment base that is lighter than milk and, therefore, rises through the milk in the udder tissue. As a result, the drug persists in the udder for more than 48 hours after it is applied, even though the udder is milked out every 12 hours.

In addition to the evidence that aureomycin kills bacteria which cause mastitis, there is the added fact that it works rapidly. In one dairy where each individual was tested and aureomycin used on those affected, the bacterial count

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Ithaca, New York, December 17, 1949

on the milk in the herd dropped to an amazingly low point just one week after treatment.

Aureomycin has a yellow color and the first milk drawn after it is used in the udder is very yellow. There is not the slightest evidence that any person would be harmed in drinking this milk, but, of course, it is not sent to market. The second and third milkings are usually colored to some extent, but after that the extra color disappears.

While aureomycin is a tremendous step forward in treating mastitis, the manufacturer emphasizes the importance of the following steps:

1. Stables should be arranged so that cows have adequate room. Udders that come in contact with cold wet floors, hang over the edge of the gutter, or that are stepped on, will still cause plenty of trouble.

2. Good milking practices must be observed. Poor practices such as leaving the milking machine on the udder too long tend to increase the difficulties from mastitis. No matter how effective a remedy may be, it is still better to prevent mastitis than it is to cure it after the cow becomes affected.

3. You will still need to consider mastitis as a herd problem and to have tests made on each quarter periodically in order to locate the mildest cases.

4. You will still need to use methods in the stable which take full advantage of modern cleanliness and sanitation.

These steps are important but the development of aureomycin promises to be a wonderful advance in the fight against mastitis. At present, no claims are made as to the effectiveness of aureomycin against Bang's disease, but experiments are being conducted and there may be good news on this angle later.

Increase Your Swine Profits

Condensed from Hog Breeder

THE average American pork producer can increase his profits with more pork with less feed, time and labor if he will more closely watch his production methods. In 1950 it will be more important than ever for the producer to keep his production costs down and to raise all those pigs to a marketable age. If he does this he can expect a handsome profit in his hog enterprise in 1950.

One-third more pork can be produced on many farms with the number of brood sows now kept. Most hog raisers can produce and save more pigs per sow. Feed makes up about 80 per cent of the cost in pork production so loss of pigs at any age means a big loss of feed. According to one experiment each pig farrowed dead represents the loss of 140 pounds of feed. Each pig farrowed alive but dying at weaning time wastes 260 pounds of feed. If the hog dies just before it is ready for slaughter, nearly half a ton of feed is lost.

It is most important to make larger and better use of pasture. Many farmers now grow legume pasture for their sows and suckling pigs; many more need to. Full-feeding of grain with a protein supplement on such pasture usually gives the cheapest and fastest gains. One acre of good pasture may save as much as 1000 pounds of corn and 500 pounds of supplement. When grain is scarce and cannot be purchased for a reasonable price, some farmers rely on good pasture and use very little additional feed until grain is harvested in the summer, or early corn in the fall.

If you do not have alfalfa pasture grow temporary grazing crops for nursing sows and pigs. During the fall, winter and spring temporary grazing crops can be provided with crimson clover, rye, wheat, oats, barley or rye grass. During the summer, lespedeza, soybeans, red clover or Sudan grass can be used. Sudan grass has a heavy carrying capacity for a short grazing period and will withstand dry weather. Dwarf Essex rape may be seeded in early spring or late summer. It requires good land, but is good temporary pasture.

When you do not have green pasture add some good quality, green colored leafy alfalfa, lespedeza or other legume hay. It, also, helps to supply necessary vitamins. The legume hay may be

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Chicago, Illinois, January 1950

fed in self-feeder hay racks, or it may be ground and mixed as 15 per cent of the grain fed to sows or 5 per cent of the pig ration. One pound of the hay is equal to nearly three-fourths of a pound of corn when fed as above. With shelled corn at $1.30 per bushel, a ton of bright green leafy alfalfa or lespedeza hay may be worth as much at $40.00.

High protein feeds, when used rightly, step up the efficiency of all other feeds and shorten the time needed to fatten hogs for market.

Feeds such as tankage, skim milk and fish meal contain proteins of better quality and higher feeding value than those of plant origin. These animal proteins supply vitamin B and essential minerals such as calcium and phosphorous. Nursing sows and pigs, up to 75 pounds, need to be given the preference in animal proteins.

The corn required for 100 pounds gain may be reduced one-third to one-half by the use of enough feed high in protein to properly balance the grain. This is a big saving of feed and greatly reduces the cost of the ration. With corn alone it usually takes 11 or more bushels to produce 100 pounds of pork. Only seven bushels of corn is required on the average for 100 pounds gain if supplemented with around 40 pounds of tankage. Often the cost of the ration can be further reduced by using a mixture of one-half tankage and one-half cottonseed, soybean or peanut meal.

The grain in rations for fattening hogs can be balanced fairly well by a supplement from one of the oil meals, or a mixture of them such as cottonseed meal, soybean meal, peanut meal, or linseed meal. If tankage or meat scraps are not to be had, the following mixture may be used.

300 pounds of one or more of the vegetable protein feeds.
100 pounds of green alfalfa meal.
20 pounds of ground limestone.
2 pounds of salt.

Do not self-feed soybean meal alone. It is very palatable and when offered free-choice the hogs will eat more than is necessary to balance the corn. Mix with other oil meals, or add ground oats, wheat middlings (shorts), or alfalfa meal.

When corn is high in price it may be possible to lower the cost of the grain in the ration by replacing some, or all, of the corn with other grains. When corn sells for $1.00 per bushel, coarsely ground small grains have comparative values per bushel as follows: Wheat $1.13; barley 79 cents and oats 40 cents. Oats are too bulky for best use by fattening pigs and should not make up over one-fourth of the brood

sow's ration. The amount of grain needed will vary with the age, size and condition of the sow. Pregnant sows need 1½ to 2 pounds per day of grain for each 100 pounds of live weight and do best when fed twice a day. Bred gilts need 2 to 2½ pounds per day of grain for each 100 pounds of live weight. Have sows and gilts in good thrifty condition at farrowing time.

Keep home-mixed minerals in a low box in a dry place before hogs at all times:

10 pounds ground limestone, air-slacked lime or hardwood ashes.
10 pounds 16% acid phosphate.
1 lb. salt.

This mixture is better, especially for brood sows:

10 pounds ground limestone.
10 pounds steamed bone meal.
1 pound salt.

In order to supply ample milk for her litter, have the sow on full feed by 10 days after farrowing and continue her on a full balanced ration until weaning time.

Sows may be hand-fed twice daily, in which case the pigs may be started on shelled corn or coarsely ground grain mixture in a shallow trough or feeder placed inside a pig creep. Pigs will begin to eat when two to three weeks of age. Beginning at four to five weeks of age, add one-fourth of a pint of supplement per pig. Increase gradually in amount until at four months of age each pig has approximately one-half of a pint daily in dry lot; on good pasture the amount of supplement eaten is reduced.

Wean pigs at around eight weeks of age, or about a week before time to breed the sow again. If hand-feeding is used, continue pigs on full feed, but reduce the sow's ration four or five days before weaning. This will reduce the milk flow.

The sow and litter may be self-fed. In this method the sow and litter have access at all times to self-feeders containing feeds from which they can balance their ration. Build a fence around the self-feeders three or four days before the sow is to be taken away, leaving openings large enough to permit the pigs access to the feeders at all times.

Remove the sow to another pasture at weaning time and allow the pigs to remain where they are used to eating and sleeping. Usually the sow can be bred in three to five days after the pigs are weaned.

Pigs can balance their own ration when given a choice of various feeds, better than man can balance it for them. Self-feeders save time and labor and reduce the cost of pork production. Proper management can help save feeds. They should not be allowed to become stale, sour, and

unpalatable by feeding in poorly made self-feeders, or by keeping more protein supplement feed in the self-feeder than can be eaten by the hogs in two or three days. Self-feeders should be covered so that rain or dust cannot spoil the feed. Do not allow dry sows to have access to a self-feeder. They may get too fat.

Keep plenty of clear water near at hand. An 80-pound pig will drink about 1½ gallons daily. If you do not have running water a homemade barrel waterer can be used.

Trees afford good shade, but if there are no trees, use old boards or woven wire over several posts and cover with hay, straw or weeds to a depth of two feet.

Well-kept sows average 2 pigs per litter more than those not properly cared for. The average birth weight should be 2¼ or more pounds as contrasted with 2 pounds or less for poorly kept sows. When pigs weigh 2 pounds or under at birth less than 50 per cent of them live to weaning age.

Keep pregnant sows and gilts on good pasture. In addition to 5 to 7 ears of corn, or 3 to 4 pounds of other grains, feed 1/4 to 1/3 pound of protein supplement daily. At least part of this needs to come from an animal source as tankage or skim milk. Three pounds of skim milk to each pound of grain will balance the ration. Have the sow in medium flesh but gaining in weight at the time of breeding. The gestation period is usually from 112 to 115 days. During this time the sow should gain from 70 to 90 pounds. Increase the amount of feed given during the last 40 days of this period as the unborn pigs develop rapidly then.

Breed for two litters per year. February and March farrowed pigs sold as fat hogs in August and September usually pay best. September pigs can be full fed for the spring peak in March and April. To have pigs farrowed about the first of March and September the sow must be bred around the 10th of November and May.

Brood sows need exercise if they are to farrow strong pigs. Locate the sleeping quarters 150 to 200 yards from the place the sows are fed and watered so as to force them to exercise.

Confine the sow to the vicinity of her farrowing quarters about three days before she is due to farrow. Feed lightly with bulky laxative feeds for a day or two before farrowing. Provide sow with water, but no feed for 24 hours after farrowing. For the first feed, use a handful or two of bran, or oats. This amount may be increased gradually at each feeding until the sow is on full feed again. This will take a week to 10 days and the bran and oats need to be gradually replaced by

corn and other grain, wheat shorts and tankage. If the feed is increased too rapidly the sow may milk too heavily and the pigs may develop scours, or the sow may develop a caked udder. The milk flow, however, should be stimulated by increasing the feed as rapidly as the pigs can use the milk without scouring.

The quickest and cheapest way of increasing the pork supply is to save more of the pigs. One-third of all pigs farrowed are lost during the suckling period. Almost one-third of those lost are mashed to death by the sow. Guard rails placed 8 inches off the floor and some 8 inches from the inner wall of the farrowing pen help to keep the sow from crushing her pigs. Bed lightly with fresh clean bedding of short chopped straw or chaff. Pigs get tangled in long straw. If too much bedding is supplied, the sow will fill up the space under the guard rails.

See that farrowing quarters are dry, clean, airy and protect the pigs from heat, cold and winds. An electric brooder properly set in the corner of the pen helps to save the pigs by keeping them warm and out of the way of the sow.

A good home-made brooder can be made with a 12 to 14 inch reflector and 150 watt bulb placed 10 inches above the floor in one corner of the farrowing pen. A lantern may be used where there is no electricity if proper care is taken against fire. Slope the floor of the farrowing house slightly toward the brooder so the pigs will find it at once.

Many hogmen who are successful in saving large litters make it a point to be on the job at farrowing time, especially in cold weather. Occasionally the sow may need some assistance and it may be necessary to free the new born pigs from the enveloping membrane, and to help them reach the mother's teats. Drying off the pigs in cold weather prevents chilling. As soon as the afterbirth is expelled, the attendant removes it from the pen as well as any dead pigs and soiled bedding. The attendant may cut the navel cord to 1½ inches and paint with 10 per cent solution of iodine.

Pigs raised the healthy way are ready for market two or three months earlier than those produced the "wormy" way. The healthy pigs require an average of one-fifth less feed and gains are speeded up so that they are able to reach the early peak market. More pigs are saved per sow and more pork is raised from fewer sows.

Internal parasites, particularly roundworms, cause many unhealthy pigs. Millions of eggs are present in old hog lots and sows kept in these places carry thou-

sands of worm eggs on their teats and udders. These eggs are too small to see with the naked eye. Unless the sow is thoroughly washed and placed in clean quarters ahead of farrowing, the newly born pigs swallow hundreds of these eggs while nursing.

Damage by worms can be prevented by doing a few simple jobs. First, thoroughly scrub the farrowing pen with scalding water and commercial lye a few days ahead of farrowing date of the sow. Use one pound of lye to 30 gallons of water. If the house is movable, place it on lot or pasture which has not been used by hogs for two or more years or has been plowed and seeded since last used by hogs. Second, scrub the sow with warm water and soap before placing her in the freshly prepared pen two or three days ahead of farrowing. Pay special attention to the udder. When the sow has dried off, oil her to control lice and mange. Third, if the sow and pigs have to be moved across ground on which older hogs have run, haul them to keep them from picking up worm eggs on the way. Fourth, keep the pigs on clean ground away from old hog lots until they weigh at least 100 pounds.

If proper sanitation is not used, pigs usually become wormy. It is then necessary to give them medicine to get rid of the worms.

If hog cholera is prevalent, vaccinate the pigs at seven to eight weeks of age. Castrate the boar pigs ahead of this time—at five to six weeks of age.

Experimental work shows that well-bred pigs gain a third faster than scrubs and on a fifth less feed per pound of gain. Medium type hogs sell best on the market. Use care in choosing gilts and boar for seed stock. The function of the brood sow is to produce pigs at a profit. The cost of keeping a sow on the farm is the same regardless of the number of pigs she produces. Select only vigorous animals from prolific, early maturing stock. Keep only the most rapid gaining individuals from litters of 8 or more pigs saved for breeding stock. Select only sows that are gentle and have 10 or more well-developed teats. Use a good medium type purebred boar.

Nature's Quirks In The Dairy Herd

Condensed from The Ayrshire Digest

DISTRIBUTED throughout our millions of improved dairy cattle are minority groups that have inherited certain physical characteristics that distinguish them from the vast majority of cattle. Conspicuous among these inherited peculiarities are wry tails, wry faces, and cropped ears, as well as other lesser known conditions.

Breeders who have had experience with these abnormalities have noted that they may be transmitted from generation to generation—a fact that scientists have confirmed through research.

It is also true that in the estimation of many breeders some of these abnormalities are of little importance; although there are those who object to them as disfiguring their herds, and in some cases their efficiency.

In recent years scientists have studied these inherent oddities, and consequently, herd owners now have available authoritative information regarding nature's way of transmitting these peculiarities. Many breeders prefer to have as few such cattle in their herds as possible, and are achieving that end by following the scientists recommendations.

Discussions of the prevalence of these quirks of nature in the Ayrshire breed (as well as in other breeds) has brought forth the point that many owners work with cattle for years without noting wry tails and wry faces, while in fewer cases cropped ears have been overlooked.

In an effort to determine the frequency of these and other abnormalities in the Ayrshire breed, classification inspectors have been instructed to report their findings on their classification reports to the Association office.

In the first 6358 animals inspected after this order was given there were 89 reported as having wry tails which was 1.4% of the total. Only six, or .09% of the cows classified showed wry faces. Cropped ears were identified in 53 animals, or .83%.

Maurice Benson reported that while classifying a New York State herd he noted that a prominent cow had a distinctly wry tail. Upon further study of the herd he found that two of her daughters and a granddaughter each had wry tails. When the attention of the owner and herdsman was drawn to this family group, they admitted that they had not noted this condition. Undoubtedly, there may be many cases in which

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breeders are unknowingly breeding these abnormalities throughout their herd without realizing that such is the case.

Although unofficial reports have been made to the effect that there is an inclination toward wry tails and wry faces in the same animal, the reports of the Association's classification inspectors indicate that there were 15 wry tails to one wry face. In some cases the wry face and wry tail were on the same animal.

The cropped or notched ear characteristic probably holds the record for being the oldest known abnormality affecting dairy cattle. The early records that enlightened this subject came about through the practice of including in some of the early Ayrshire registry volumes notes that described the distribution of color markings and in addition, remarks regarding cropped ears.

In 1915 the Japanese student, J. Yamane, at Tohuku Imperial University, developed a thesis on the topic of cropped or notched ears. Student Yamane studied the early American Herd Books and discovered that Scottish-bred Ayrshire sire, Eglinton 21, born in 1859, that was imported to the United States from Scotland had, according to the Herd Books, 21 calves with notched ears. A descendant of this sire, Express 4503, was purchased in California and was shipped to Japan where he is reported to have sired 35 offspring with notched ears. It is also well-known by Ayrshire breeders that there are variations in the type of notch that is transmitted within certain groups of cattle.

The notched ear is regarded as a dominant characteristic. In other words, the mating of a cropeared Ayrshire to an Ayrshire with normal ears will usually result in calves with the cropped characteristic. Scientists also report that the degree to which the ear is notched may depend upon the percentage of cropped-ear ancestry.

The wry tail is a definite malformation of the rump. Dr. Lester O. Gilmore, who has pioneered in studying the structure of the rumps of cattle with wry tails has, by means of X-ray equipment, learned more about the structure. According to Dr. Gilmore in the case of wry-tail cows the 'tail-head' or the vertebrae that extend the length of the rump are twisted at an angle from the usual direct line that extends from the center of the loin through 'center' of the rump and tail.

It is a well-known fact that the rump is considered of major importance in judging type, and that it has considerable effect upon sales value. It has been found that a part of the abnormal condition as shown by the lower side of the rump is due to the fact that the sacral vertebrae grows longer

on one side of the rump than on the other. In addition, there is a greater distance between the vertebrae on the side of longer measurements. Drs. Gilmore and Sellers reported that the condition of one side of the rump being lower than the other, and the bones being farther apart has been noted in young heifers, but there is no record of its being found at the time of birth. This characteristic of the wry tail, which might well be called a 'wry rump' is inherited.

The wry-tail characteristic is reported by Professor F. W. Atkeson and his associates as carried by a recessive gene. In view of the relatively few wry-tail Ayrshires, it is suggested that a campaign within the breed to register no calves from wry-tail parents, and to sell as registered no 'wry-tail' cattle that are known to have ancestors with this character should produce the desired effects.

The wry-face condition is, in most cases, less conspicuous than other inherited abnormalities. It is no doubt true that the condition is probably the most difficult to identify. Apparently there has been relatively little research on the structure of the wry face.

Old Cows Resist Mastitis

It is a common belief that old cows have less resistance to mastitis than younger ones. But it's not so, say two University of California veterinarians.

They studied 629 cows of all ages and found that age makes no real difference. The only reason that old cows have more mastitis is because they have been exposed longer, and have had more chance to pick up teat injuries.

They discount another general belief: that cows once infected have less resistance from then on. Cows that have never been infected, they say, are practically as susceptible.

Most important cause of mastitis is injury to the udder; particularly to teat openings.

When you do these things you help bring on mastitis: milk irregularly; use rough or wet-hand milking methods; expose cows to cold and dampness; keep cows in unsanitary barns; make cows climb over high barn sills; let flies feed on infected milk and crawl on end of cow's teats; raise calves on infected milk and let them suck each other; leave milking machines on after cow is milked; let machine vacuum get too high; fail to milk all the milk out; or force-feed infected cows for high production.

—Farm Journal

Cannibals Cost Money

Condensed from Eastern States Cooperator

Wilbur O. Wilson
Agricultural Experiment Station, Davis, California

CHICKENS and turkeys normally feed on grains, vegetation and meat, but under certain conditions they may become meat eaters to the extent of becoming cannibalistic.

In baby chicks, toe-picking is the first symptom; feather picking comes later. The soft quills which are filled with blood are especially appetizing to the cannibals. Small feathers on the back and wings are most easily accessible for picking. Feather picking also occurs around the vent and tail. Once blood has been drawn from a bird, its pen mates literally see red and they go to work picking blood and meat from the victim. Unless the picked bird is removed or treated it will be picked to death, as will others, for cannibalism once started is a vicious habit. Cannibalism is not confined to chickens. Pheasants and game birds raised in captivity are notorious feather pickers. Turkeys and ducks may also become cannibalistic.

The prevalence of cannibalism varies from flock to flock and season to season. In some extreme cases mortality as high as 40 percent has been reported. Even in cases where the mortality is kept at a low level, losses in market value may occur. The increase in the number of bare-backed and blue-backed birds in the case of colored turkeys results from cannibalism. Bruises and torn skin and scabs in picked areas also result from this vice.

The causes of cannibalism are uncertain and very complex, and probably involve the nutrition of the bird, its genetic background and its management.

It is likely that a deficiency of any one of several nutrients may cause the bird to have a depraved appetite and may lead to cannibalism.

It is also possible that there exist specific factors which are needed to prevent cannibalism and other factors whose presence in a ration is conducive to the vice.

The reported prevalence of cannibalism on high corn-containing feeds indicates that corn is a factor to watch. It is very true that not all rations high in corn promote cannibalism, and I am not sure whether corn contains a factor which promotes canni-

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balism or if corn lacks a factor which should be added to prevent cannibalism. At any rate there are some rations which use corn that are satisfactory and some which are not.

Fiber has repeatedly been reported as playing a role, more especially the fiber of oat hulls. The recent reported success of raising broilers on high corn and low fiber rations does not necessarily cast doubt on the previous reports of the effects of corn and fiber on cannibalism, but it certainly adds confusion to the problem and emphasizes its complexity.

Mineral supplements such as sodium chloride, calcium chloride and manganese seem also to play uncertain roles. Certain protein supplements may in some instances be a limiting factor.

It will be impossible to do reliable research until cannibalism can be produced experimentally at will. A good example of the difficulties involved is that experienced at the Poultry Division of the University of California.

A severe outbreak of cannibalism occurred in chicks from breeder hens on an experimental diet composed largely of polished rice and fishmeal. Preliminary studies indicated that corn aggravated and oats prevented the condition. A crucial experiment was then set up with sufficient numbers to prove or disprove these preliminary observations. Precisely at this time the chicks ceased to be cannibalistic, although there was no change in the feed, the management or the birds. The whole investigation yielded nothing definite in the way of results. It is not known why cannibalism started nor why it ended.

Many management factors have been alleged to play important roles in cannibalism — among them, overcrowding, insufficient feeding and watering facilities, and keeping the birds on wire floors. Yet when all management factors alleged to promote cannibalism are combined in an effort to produce cannibalism failure frequently results, rendering uncertain the role that is played by management of the birds.

It has been observed that lots of birds from different hatcheries on the same feed and under the same management may all be free from cannibalism except perhaps for one pen. This points to the involvement of a genetic factor in cannibalism. The ration of the breeder hens may play a role here and the problem may still be nutritional. Breed and strain differences allegedly exist. It is not certain whether the tendency is to cannibalize or to be a ready victim.

The most logical nutritional preventive measure which has been suggested is the feeding of the most complete diet that is

possible, so that if there are nutritional factors required to prevent cannibalism it would make their chance inclusion most possible.

There are more specific nutritional recommendations: among them the feeding of manganese; extra salt; fresh greens; and various types of fiber such as those of wheat bran, dehydrated alfalfa and oat hulls. None of these nutritional measures has yielded consistent results in entirely eliminating cannibalism.

Among the managemental recommendations for combating cannibalism are: (1) Prevention of overcrowding; (2) Provision of adequate feeding and watering facilities; (3) Devices to keep birds busy; (4) Ruby colored lights so that birds will not see bloody parts of picked birds; (5) Antipick salves which taste unpleasant to the birds.

Many mechanical devices for the prevention of picking have been recommended. Some prevent the bird from picking, except downward. Others are blinders which prevent birds from seeing straight ahead. Red plastic blinders have been developed which make everything in front of the bird appear red, but the objects to the side are unaffected. These mechanical devices have been used more or less successfully in various places.

Debeaking is the surest means of controling cannibalism. The procedure is to remove a portion —about one-half—of the upper beak by means of a heated knife or iron which cauterizes the tissue and prevent bleeding. When about one-half of the upper beak is removed—according to general observations—it takes about six months to grow back. The rate of debeaking varies with operators and their experience. A crew of two men can debeak about 300 birds per hour.

The most certain information on cannibalism is its uncertainty and complexity. This is not surprising since inheritance, management and nutrition may all be involved in its expression. Reports on studies of cannibalism are numerous, which is a measure of how little accurate and reliable information is available on the subject.

Until such a time as cannibalism can be produced at will, there will be little hope for a successful attack on the problem.

Nitrate by Air

Condensed from Kansas Farmer

Ed Rupp

You can spread ammonium nitrate efficiently with an airplane. It was done on several hundred acres in Cowley county, Kansas last year. And chances are that even more will be spread from the air this winter.

Due to wet soil or snow conditions, applying ammonium nitrate on small grains often is a catch-as-catch-can job. The fertilizer should be applied to wheat before March for best results. But often it is impossible to get on the fields before March. That was true over large areas last year. Much nitrate was applied in April, too late for best results.

Oliver Shoup, Cowley county farmer, and Cecil King, Winfield airport operator, beat the mud last year. They applied the fertilizer with a plane equipped for dusting and seeding work. Mr. King applied 75 pounds of ammonium nitrate an acre on 110 acres of wheat on the Shoup farm.

While the fertilizing job was being done, Mr. Shoup placed a large canvas out in the wheat field. It looked as if the plane were doing an even job of spreading as there was an even sprinkling of fertilizer on the tarpaulin. Nitrate on the tarpaulin was gathered up and spread elsewhere on the field. The spot without nitrate was visible thruout the wheat-growing season. Mr. King says you could nearly measure the size of the canvas by the spot left in the field.

Final result of the nitrate application on the Shoup farm looked like this: No nitrate, 24 bushels an acre. With nitrate, 75 pounds an acre, 32 bushels an acre. This fertilizer was put on in March.

It was the first year Mr. King had tried spreading fertilizer by airplane. He applied 22,300 pounds of the chemical with a Stearman plane. With the exception of 100 pounds an acre applied on 60 acres of oats, all was applied to wheat at the rate of 75 pounds.

There had to be some experimenting done. As it turned out, Mr. King says his first job was the best. He flew 25 to 30 feet above the ground on that job and distribution was better than when flying closer to the ground. When flying lower the crop was streaked and it ripened unevenly. Apparently the fertilizer was not distributed evenly.

Mr. King was able to haul a

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Topeka, Kansas, December 3, 1949

pay load of about 600 pounds of fertilizer in the Stearman that was equipped with a 220-horsepower engine. This year he plans to install a 450-horsepower engine that will increase speed of the plane 20 to 25 per cent and increase the pay load up to 800 or 900 pounds. With the increase in power shorter turns at the end of the field will be possible, a timesaver as well as a safety factor.

Cost of application to the farmer was about $4.30 an acre, Mr. King reports. That included fertilizer. Application expenses alone were figured at 2 cents a pound, or $1.50 an acre for 75 pounds of nitrate.

The fertilizer was applied at the rate of 30 acres an hour. But Mr. King hopes to double that. Increased speed of the plane will acount for some saving of time. Last year it took longer to empty the fertilizer sacks into the plane than to spread the chemical.

This year Mr. King says he intends to fill the hopper in the plane with a special device that will eliminate much of the ground time. Improvements in efficiency which he has in mind will bring the price of application down below the level of $1.50 an acre. Perhaps quite close even to the price asked for ground application of the fertilizer.

Cows Gain on Early Hay; Lose on Late-Cut

Here's something to remember when haying season rolls around again. Cattle at the North Carolina Station did much better last winter on early cut grass hay than they did on hay cut at full maturity.

The North Carolina specialists cut some hay in the early bloom stage, and the rest six weeks later. They fed this at the rate of 20 pounds a day per cow to a divided herd. In 2½ months the cows on the early-cut hay gained 15 pounds apiece. The cows on the late-cut hay lost 10 pounds a head during the same time.

The calves got eight pounds of hay and two of grain a day. Those on the early hay gained 22 pounds apiece, while the others gained only 12.

The North Carolina folks do admit that you'll probably get only three-fourths as much hay when you cut it early. But they also say it is worth more than the difference in feed, and you'll get more fall pasture—which more than evens things up.

—Farm Journal

Chips on The Land

Condensed from American Forests

Robert A. Schrack and L. Russell Albright

UNTIL recently farmers had to be converted to woodlot management chiefly on the strength of profits which could be obtained from occasional sales of logs, poles, or pulpwood. Too often the farmer weighed his modest profit against the problem of disposing of the tree tops and branches which cluttered his woods after logging, thinning, or pruning. Such debris hindered putting his land back into productivity. Furthermore, it created a fire hazard.

But now the farmer can convert those tree tops and branches into woodchips which will enrich the soil of his land, mulch his strawberries, or perform countless other useful functions around his farm. Such an economical and practical solution is offered by a portable wood-chipper developed at Fitchburg, Massachusetts.

It is fascinating to contemplate the actual and potential uses of wood chips. Arthur C. McIntyre, chief of the Northeast Region Forestry Division of the Soil Conservation Service, will tell you he has seen several cases of excellent farm crops being grown on soils that have been heavily treated with wood. Research has disproved the old wives' tale that "wood makes soil turn sour."

Wood is organic matter in its cheapest form. In addition, it is a longer lasting form than that produced by the usual green manure and cover crops of soybeans and rye. Organic matter, as it breaks down after having been applied to the soil, produces humus. A high humus content is one of the essentials of good crop soils. It makes heavy soils more porous and easy to work—aids soil aeration and root penetration. It improves physical structure and increases production, and enhances the water-holding capacity of light soils. A high humus content is one of the best aids in the control of soil erosion by wind or water. Thus it is easy to understand why every farmer is continually concerned about it.

The suggestion has been made that the farmer might produce chips from waste material in his woodland and apply them directly to his fields. It is more logical to assume, however, that the chips will find their way to the soil by

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an intermediate use. There is a continual demand for sawdust, shavings and small chips produced from mill waste. The farmer needs such material in his dairy barn, his poultry house and as mulch for his strawberry bed. There is always a steady pressure of demand against available supply.

These chips can be produced economically with the new wood-chipping machine. Studies made of operations on the Scituate watershed near Providence, Rhode Island, show that a ton of wood in branch or bolt form can be turned into chips at a cost of about two dollars. This puts chips on a competitive basis with other sources of organic matter used by the farmer.

Straw, for example, sells for more than $15 a ton. Sawmill operators have no difficulty selling sawdust for $3.25 a ton, and some report prices as high as $5. Farmers will drive their own trucks considerable distances to planing mills to buy shavings at about $7 a ton.

In New England, sawdust, shavings and straw are in demand around dairy barns because of their ability to absorb moisture. Chips would be equally effective, and would even serve the same purpose in poultry houses. The Rhode Island Agricultural Experiment Station, has planned chip trials for both dairy barn and poultry house. Dr. Vladimir Shutak, encouraged by favorable results of mulching strawberries with chips last year, plans to expand his trials this year to include blueberries and orchards.

The use of wood as a mulch is not new. James G. Chadbourne of North Bridgeton, Maine, has been using sawdust for thirty years. Home gardeners have also reported equal success, citing more uniform soil temperatures, better retention of soil moisture and reduced cost of weed control. Commercial nurseries may find it valuable to replenish organic matter lost when topsoil is depleted through sale of balled ornamental stock.

Chips as a source of compost material should also interest the organic gardener. There is every possibility that composting will reduce the nitrogen deficiency which must be corrected whenever the woody material is applied to the soil. The population of micro-organisms in the soil increases rapidly as organic matter decomposes. This process ties up otherwise available nitrogen which must therefore be increased by additional applications during decomposition. This should be kept in mind when chips are used as a source of organic matter.

For dramatic proof of the workability of the wood-chipping machine on large scale operations, one might visit the Scituate water-

shed area of some 14,000 acres owned by the city of Providence, Rhode Island, and managed by the city Water Supply Board. There a chipping unit has been in use since late 1946. The machine is small and compact. Although it is of heavy duty construction, it is so highly portable that it can be towed along the highway at a speed of thirty-five miles an hour.

Complete with power unit, it is only four feet wide and eight feet long, and its ton and one-half weight is so well balanced on pneumatic tires that two men can easily unhitch it from the jeep which tows it and maneuver it into position for use. A sixty-horse-power gasoline engine is mounted on the front of the semi-trailer. The chipping unit itself is in the rear, and consists of a heavy fly wheel with four cutting knives bolted to it. The chipping wheel, operating at 2,200 revolutions per minute, creates an air pressure strong enough to blow the chipped wood fifteen to twenty feet from the machine.

Bill O'Rourke, crew foreman, prefers to take visitors on a bit of a tour, beginning with the earliest job in which the chipping unit was uesd, before he shows the machine in operation. At the site of the first operation one can see only pine needles on the forest floor. It's necessary to brush the needles away to find any chips, and even then it's imposible to get a clear sample of the chips, so thoroughly has nature mixed fallen needles with them.

One can note the soft and decayed appearance of the chips. Rubbed between the hands, the chips become a fluffy mass of organic matter. Only the larger chunks are recognizable, for in two years they have reached an advanced stage of decomposition. At another plantation worked over just a year ago one must still scrape away pine needles to find chips, but decomposition isn't nearly as far advanced.

Bill is then ready to show the machine in action on a plantation of mixed red and white pines. As a result of damage by the white pine weevil, nearly all stems of this species have been overtopped by the red pine and are being removed. Two men are cutting down the marked trees while others are chopping off the side branches and tops. Crews are piling tops and branches with butts pointing toward a central clear alley-way between the rows of trees. The chipper does its job so rapidly that it's necessary to to operate it only a couple of hours each day.

The starter button is pressed, the machine starts with a roar, and the operator climbs into the jeep and starts driving toward the cleared alley-way. Men start feeding tops and branches into the chipper's wide mouth. Butt ends

are fed first so that the end comes in contact with the revolving disc which carries the cutting knives. The machine does the rest. In a few seconds the entire branch has been drawn through the chipper.

A pile of branches originally as big as the jeep itself can now, in the form of chips, be placed in a bushel basket. Bill enumerates the advantages of the machine: "Before we had this machine we burned all our slash. Of course we had to stop woods work just as soon as spring or fall fire season came along. Now we can work summer or winter, spring or fall. As far as this machine is concerned there just isn't any fire season. We used to destroy all of this organic matter when we got rid of our slash by burning it. Now one man scatters the chips over the ground if the piles are too big, and they'll soon be part of the soil. And it's costing us less than half as much."

The chipper has helped solve the problem of fire protection by providing a financially feasible means of disposing of the slash resulting from thinning and pruning operations.

Results of this operation have encouraged others in increasing numbers to give the chipping machine a trial. When agricultural uses are being considered, chip size is an important factor. Chips produced by a machine equipped with ordinary straight-edged knives are too large for any farm use except orchard mulch. Much smaller chips can be produced by replacing alternate knives with especially designed "sawtooth knives." Chip size can further be varied by changing the adjustments.

Chipping units at present are too expensive to be owned by the average farmer or woodland owner. However, they could be owned, operated and made available on a community basis by Soil Conservation districts and similar organizations. The Northeast Region of the Soil Conservation Service has purchased a machine for trial and observational purposes, and information thus gained will be made available to District governing bodies.

Community operation would make it practical for the farmer and other woodland owners to obtain their fuel, lumber and other wood requirements, with chips produced as a by-product from branches and other tree waste. The chips will eventually find their way back to the soil by way of the dairy barn, poultry house or as mulch. Soils so treated, because of their increased organic matter will be more productive, easier to work and less subject to damage by wind and water erosion.

Such utilization of wood chips should be encouraging to woodland owers, foresters and conservationists. There is an almost in-

exhaustible supply of low grade and other waste material suitable for the manufacture of such chips. Rhode Island alone has approximately 360 thousand acres, or ninety-two percent, of its total forest covered with stands less than forty years of age, all of which is in need of improvement cuttings and thinnings. Spread over the country as a whole the amount of waste and low-grade material available is unlimited.

Large scale utilization of wood chips would enable the woodland owner to make the cuttings necessary to good management of young forest stands at a profit. Woods waste would theoretically consist only of stumps, leaves and branches from natural pruning in the forest.

Know How to Measure Standing Timber

Planning to sell your standing timber this year? If you are, get a cruising and scaling stick and protect yourself against gyp buyers, advises Robert B. Parmenter, Extension Service Forester at the University of Massachusetts.

There's nothing hard or mysterious about estimating the board feet in your standing timber the way he explains it:

1. Hold cruising stick at arm's length against trunk of tree. Using your eye for the focal point of triangle, line up the left end of cruising stick with your eye and left side of tree. Without moving the head, notice where line of sight crosses scale and the right side of tree. Diameter of tree outside bark is read off in inches at this point.

2. Merchantable length is found by standing 59 feet away from tree and by holding the cruising stick at arm's length with the top edge in line with your eye and top of last log. Notice where line from eye to stump height crosses lower part of stick. Number of 16 foot logs in tree read off at this point.

3. Matching figures received in steps 1 and 2 to table on stick gives number of board feet in tree.

The farmer may also check on buyers by using the International Log Rule. To use this scaling stick a farmer need only know the length of log and measure the diameter inside the bark at small end.

The sticks may be obtained from The Federal Land Bank of Springfield, Massachusetts, at $1.50 a set.

—Charles L. Stratton

Safflower—Newest Old Crop

Condensed from Marketing Activities

Archie R. Sabin

In 1949 safflower was grown for the first time on a commercial scale in the United States when nearly 40,000 acres were harvested. This immigrant from the dry land areas of India, Turkestan, and Africa shows distinct promise of becoming a solid American citizen.

Safflower, a thistle-like plant, was cultivated for several thousand years as source of a dye obtained from the flower. Seeds of the plant have been found in the tombs of the Pharaohs. Today's interest in safflower, however, is in the oil and meal derived from the seed. Although the oil is used extensively in India for edible purposes, and for soap, the principal use of this year's production in the United States will be as a drying oil in protective coatings. Safflower seed oil is considered equal to linseed oil for many purposes and superior in some. Of special significance is the fact that paint made with safflower oil is resistant to yellowing, a common characteristic of paints made with linseed oil.

The sudden commercial interest in safflower comes from several sources. Over two decades of experimental production show it to be well adapted to the semi-arid areas of the West where wheat and flax have long been important crops. Faced with reduced wheat acreage and substantially lower flax prices, many farmers are looking to safflower to help fill the gap. Moreover, newly developed varieties having higher oil content are now available for planting. Under average conditions safflower should compare favorably with wheat as a cash crop. In addition, the plant is exceptionally drought resistant and often yields enough to justify harvesting under conditions that make wheat a total failure.

In 1949 several thousand acres of safflower were planted on land where winter wheat seeded in the fall of 1948 had winterkilled. This possibility of making a crop on acreage otherwise lost is also a point of interest to farmers, since, for example, the 10-year 1936–45, average abandonment of wheat acreage was 17 percent in Nebraska and 23 percent in Colorado. On dry land safflower yields about 750 lbs. per acre on the average while irrigated fields can be expected to produce 2,000 lbs. or more per acre.

Progressive farmers in the West-

Reprinted by permission from Marketing Activities
Washington, D. C., November 1949

ern Great Plains have long felt the need for a new crop to include in their rotation plans. The cost of producing safflower approximates that for wheat since planting and harvesting machinery can be used interchangeably. Because planting seasons differ for these crops, and safflower ripens later in the fall, fuller utilization of the farmer's machines and more even distribution of his time are permitted.

Another important consideration strengthening the position of safflower is that the meal provides a protein supplement for livestock in areas which heretofore have had to ship in meal at considerable expense from hundreds of miles away. Experiments indicate that safflower meal is comparable in feeding value to soybean meal when fed on an equal basis. When oil is extracted without removing the hulls, protein content of the oil seed cake from newer varieties now being recommended is about 25 percent.

While the ability of safflower to compete economically with other crops in the future cannot well be forecast, it is possible to compare returns from the 1949 crop. Colorado farmers are receiving 4 cents per pound for crushing stock seed. At this rate farmers' average gross return is $30 per acre on dry land and $80 per acre under irrigation. Comparison with other crops requiring similar cultural practices is shown in the following table:

Seed prices in future years will be influenced largely by the price of oil. Safflower oil is currently being sold at prices below linseed, but substantially above soybean oils. As the present price is largely introductory it is difficult to predict the price pattern in which future production will fall. In Australia safflower oil normally sells at a premium over linseed oil. Whatever the eventual rela-

Gross returns per acre for selected crops, Colorado, 1949

Crop	Yield per acre		Price[1] received by farmers	Gross return per acre	
	Dry Land	Irrigation		Dry Land	Irrigation
			Dollars	Dollars	Dollars
Safflower, lb.	750	2,000	.04	30.00	80.00
Spring wheat, bu.	20	32	1.82	35.40	58.24
Barley, bu.	25	40	.86	21.50	34.40
Beans, lb.	400	1,500	.06	24.00	90.00

[1] Prices are as at mid-September 1949.

tionship to linseed oil prices, however, it appears that safflower oil in the next few years, at least, will find a ready market at prices higher than for soybean oil.

Estimated output of oil from the 1949 safflower crop will be over 8,000,000 pounds, equal to about 1 percent of the linseed oil production. The only commercial acreage in 1949 was grown in Colorado, the Nebraska Panhandle, and some small acreage in Wyoming. One plant processing safflower exclusively is operating in Colorado while experimental lots are being processed in California and elsewhere.

Present indications point to a safflower acreage in 1950 of more than double the 1949 crop. Expansion of existing facilities and the erection of one or more additional processing plants is planned. In California, where safflower acreage was negligible in 1949, commercial scale production will be attained in 1950. Several oil companies, seeking to supplement their present oilseed sources, are arranging to contract for thousands of acres of safflower. Interest among individual California farmers also is strong and a number have visited the Colorado-Nebraska area to observe the crop and to buy certified or proved seed. Development of those strains which produce seeds of highest oil content will help strengthen the comparative position of safflower in American agriculture.

New Meat-Type Hog Gets Farm Test

Another meat-type hog, the Montana No. 1 inbred (mentioned several times before in Farm Journal), is getting its first widespread farm test this year. It has been released to commercial hog men in eight states. Like the Minnesota No. 1 and 2's, its chief use is for crossing with other lines.

The Montana No. 1 (or Hamprace) is the result of Danish Landrace and Hampshire crossing and inbreeding done at the USDA field station at Miles City, Mont. It's 55% Landrace and 45% Hampshire.

In 9 years at Miles City, the new breed has farrowed 245 litters averaging 10½ pigs at birth, and slighty more than 8 were weaned. The pigs put on 100 pounds of gain with about 370 pounds of feed, and the carcasses cut out more than 47% of the five expensive cuts—ham, loin, bacon, picnic shoulder, and picnic butt.

The hogs are good foragers; they're quiet; and they make good mothers, say the Miles City hog men.

—Farm Journal

New Chicks on Old Litter

Condensed from Everybodys Poultry Magazine

D. C. Kennard
Ohio Agricultural Experiment Station

Put day-old chicks on litter used for three years by layers? "Never!" That would have been our answer a few years ago. But when a shortage of help forced us to use old litter and we had no bad results, we decided to do some experimenting. After three years of testing, involving some 5000 layers and 25,000 chicks, we still have to run into our first disease outbreak resulting from use of old litter. Not only has the disease bogeyman failed to appear, but the system has been found to have many advantages in saving labor and, strange as it may seem, in actually reducing disease losses.

As with any other new practice, there are limitations to the use of old litter, either for chicks or ready-to-lay pullets. I would never put chicks or poults started in batteries onto old litter. Likewise, it would be foolish to put a brood of chicks on old litter which was badly caked, wet, or in otherwise poor condition. In short, if you are going to take advantage of the benefits of built-up litter, you must use more than the usual amount of common sense in adapting it to your conditions.

Instead of being unsanitary built-up litter has turned out to be a sanitary procedure for the prevention and control of certain diseases, especially coccidiosis. Eleven consecutive broods of chicks have been started and successfully raised for the first 8 to 16 weeks on the same built-up floor litter. Moreover, day-old chicks have been started and successfully raised on floor litter previously used for 3 years by hens, with only a few days between removal of hens and starting the chicks.

Old built-up floor litter is also a wonder material in its nutritional properties, since it provides the animal protein factor, including B_{12}, and riboflavin. Pullets on old built-up litter that received an all-plant diet (no meat, fish, or milk products) since they were day-old chicks made a normal rate of growth and laid as well during their first 7 months of egg production as did comparable pullets that received a complete ration, including meat, and milk by-products.

The hatchability of eggs from breeders that received the all-plant diet on old built-up litter was 72 percent, versus 27 percent from

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Hanover Pa., January 1950

similar breeders on fresh litter removed and renewed every two weeks. Chicks started on old built-up litter made the same rate of growth on the all-plant diet as did similar chicks that received the complete diet on fresh litter.

Needless to say, there is a great saving of labor and litter material. As a labor saving procedure, the system is yet to be surpassed.

Incredible as the foregoing may seem, it is a brief factual summary of the extensive experimental work which has been in progress during the past three years at the Agricultural Experiment Station at Wooster, Ohio. These were large scale experiments, conducted much the same as poultrymen brood and grow their chicks and as they manage their layers. The birds were White Leghorns, Rhode Island Reds, Leghorn x R. I. Red crosses, and New Hampshires.

The first experimental evidence with reference to the use of built-up litter as a sanitary procedure was secured by the Ohio Station in 1946, when it was first used in the brooder house. During the three years previous to 1946, when the floor litter was removed and renewed at frequent intervals, the average mortality of 10 consecutive broods, a total of 18,000 chicks, was 19 percent. During the succeeding three years with the use of built-up litter, the average mortality of 11 consecutive broods, a total of 10,000 chicks, was 7 percent. Seldom did a brood escape an attack of coccidiosis before the use of built-up litter. There was no noticeable trouble from coccidiosis in 11 consecutive broods started and raised on the same old built-up floor litter.

Mortality of the first and second broods on built-up litter was 17 and 10 percent respectively. It ranged from 2 to 8 percent, with an average of 5 percent, for broods 3 to 11. What is more, day-old chicks were started and successfully raised in laying houses on old built-up litter used 3 years previously by hens with from 1 to 14 days interval between removal of the hens and starting the chicks. These experiments have been in progress for 3 years and have involved about 1200 chicks each year.

Theoretically, pullets started as day-old chicks on hen litter might be expected to suffer a higher rate of mortality as layers, but they did not. In three experiments during 1948–49 with Leghorns, R. I. Reds, and Leghorn x R. I. Red crosses, there was little difference in egg production and a slightly lower rate of mortality of the pullets started and raised on hen litter than those started and raised in brooder houses on new built-up litter, started fresh with each brood of chicks.

No less surprising were the pullets started on hen litter in the

spring of 1949. They made a better rate of growth and were better in appearance as ready-to-lay pullets than those started on new built-up litter in brooder houses and raised on Ladino Clover. These pullets are to be tested as layers in the 1949–50 laying year, as similar pullets were last year.

Three experiments have been conducted comparing Leghorn x R. I. Red crossmated chickens which received the complete ration, including meat and milk products, with others fed an incomplete, all-plant ration, on old built-up, new built-up, and fresh litter (removed and renewed each two weeks). The average results at the end of 12 weeks of the three experiments, which included a total of about 3000 chicks, are shown in the accompanying table.

Ration	Type of Litter	Wt. per Bird	Mortality
		(Pounds)	(Percent)
Complete	Old built-up	2.45	5
"	Fresh	2.30	7
Incomplete	Old built-up	2.34	7
"	New built-up	1.88	18
	Fresh	1.64	23

Built-up litter is sometimes called deep or dry litter. These terms are misleading. Deep or dry litter may be far different and without the beneficial properties of built-up litter.

Built-up litter is what the term implies. In the beginning, fresh litter material is added from time to time as needed, but none need be removed until it becomes 8 to 12 inches deep. Once the litter is built-up, some of the material will need to be removed occasionally to keep it within bounds. When the litter starts to cake or paste over the surface from dampness, it needs to be stirred from time to time. The addition of hydrated lime when the litter is stirred aids in keeping the litter in a better and more absorbent condition.

When should floor litter be cleaned out? We don't know. When the litter becomes 12 to 16 inches deep, it may be necessary to remove part of the litter for convenience. We have never encountered any conditions or circumstances which indicated that it was necessary, or even advisable to remove all the litter from the pens. This is true despite the fact that our birds have most all of the diseases and parasites to which chickens in the Midwest are subject, except for pox, laryngotracheitis, and acute cholera.

Our chickens have worms, but they present no problem. They, no doubt, have been liberally exposed to leucosis, pullorum, and other diseases.

There is little likelihood of a necessity for complete removal of the litter on account of coryza, fowl pox, newcastle or any of the respiratory diseases since viruses are so shortlived outside the birds' body.

Red mites could be a problem, but we have not had any trouble with them as yet. Lice must live on the body, so present no more of a problem than with any other litter system. Probably the usual spraying procedure will prevent or control external parasites, particularly where roosts and pits are used.

Presumably, if an outbreak of cholera, cholera-like diseases, or typhoid occurred, it would be necessary to completely remove all of the litter. No such instance has yet come to our attention, however.

When convenience dictates that some of the litter be removed, usually between broods of chicks, after about the third brood, and from laying houses when hens are replaced by pullets, any caked or wet litter should be taken out first. Then sufficient additional litter should be removed to get the depth down to not less than 8 inches. Where the litter is all in good shape, the easiest way to handle the job is to take all of the litter out of one section, then level the remaining material off to about 8 inches.

In winter and early spring, when litter is inclined to become damp, sticky and caked litter should be removed from around waterers and feeders, being replaced with other old litter.

Not all poultrymen will want to change over to the old built-up litter system, of course. In this article, I have not attempted to sell the idea. I have only reported on our experiences with it. The system has worked as well on practical farms where it is being used. When the system is combined with common sense and good management, we believe it can be of real value in saving labor and reducing disease losses.

Farm Laborer to Farm Owner

Condensed from Acco Press

Bill Tipton

BACK in 1909, a young man left the 65-acre Montague County farm in North Texas where he had been reared to make his way in the world. All his worldly possessions were packed in a flour sack on his back as he turned west to find work and make a stake to start farming for himself.

In the dark of the night in Wichita Falls, on a bench on the railroad station platform, he changed into some clean clothes from that flour sack. He found employment in Hardeman

Reprinted by permission from Acco Press
Houston, Texas, November 1949

County, worked two years for twenty dollars a month and board, until he had saved up enough money to buy a span of mules, rent some land, and start farming. He began in Collingsworth County, near Wellington, as a tenant farmer, then in 1918 bought a small piece of worn-out land, and a little later the 420-acre "home place."

A good many years later this farmer, well-established, successful, sat on that same bench on the Wichita Falls railroad station platform, waiting for a train. In his pocket was a bank draft large enough to pay for 24,000 acres of land for sale by the government in Cochran County, out next to the New Mexico line—a ranch for which he had outbid nine oil companies in competitive sealed bidding in which his bid was twenty cents an acre the highest. This farmer's hunch about that land has paid off, for today it is completely proved for oil production, has six producing wells on it, is estimated to have a potential of 500 to 600 wells!

This "fabulous Texan" is F. O. Masten, whose operations at Wellington, Sudan, and Morton are well known in farming and ranching circles. This year, he and his tenants have 14,000 acres in cotton and 6,000 acres in grain sorghums, besides the cattle-oil ranch which is leased out. One of the Southwest's largest individual farmers, he's worked hard for all that he has.

Those who know F. O. Masten and his farming operations over the years say that he knows farming and never misses a bet to make a better crop. Back in his earlier days at Wellington, whenever his wagons would haul a load of cotton to the gin, he himself would go by the bur pile after he had unloaded, and load up burs—a nuisance which the gin was glad to have hauled away. Masten spread these burs on his land, smiled happily the next year when this land produced 60 pounds of lint cotton to the acre more than adjoining land which hadn't had the bur treatment.

In those same early days, Mr. Masten called on the operators of the old Shamrock Cottonoil Company at Shamrock, 26 miles from his Wellington farm, and dickered with them for fertilizer from their pens.

"I'll load it up and haul it away, if you'll give me the fertilizer," he propositioned them. Seizing an opportunity to get their pens cleaned out, the cottonoil mill folks agreed, provided he worked one pen at a time. This was in the mule-and-wagon days, and this was a 26-mile haul over dirt roads, but Masten saw an opportunity to improve his land by the output of a little labor and hauling with his own farm crew. It was also before the day of such specialized

farm equipment as a manure spreader, but he got the job done by scattering fertilizer off the back of the wagon with shovels.

The next year, he got an additional 105 pounds of lint cotton to the acre on several hundred acres treated with this fine fertilizer, then got the carryover effect in the following years—75 pounds more the second year, 50 pounds additional the third year. Those figures are an indication of another Masten characteristic: he kept accurate records on all his land, knew what practices stepped up production.

As far as is known, Mr. Masten was the first in that section of West Texas to make as much as two bales of cotton to the acre on dry-land operation. He has made better than three bales to the acre on some of his Wellington land, heavily fertilized, with good subirrigation.

Over the years, it has been Mr. Masten's hobby to build up land, and he never hesitates to tackle what others consider a worn-out piece of land. Humus, manure and fertilizers, combined with green manure legume crops, have worked wonders for his land. It's no accident that he's a Master Farmer, chosen in 1928, and he has been president of the Texas Master Farmers twice, president of the national organization once.

Mr. Masten has a touch of mechanical inventive ability, too, which has come in handy in farming. Back in 1946 *Life Magazine* publicized one of his achievements, the running of a group of tractors without operators in the seat. This was made possible by a simple guide bar, which he designed and built in his own farm shop. He had noticed that "toed-in" plows stayed in the furrows easier, and since he couldn't get tractor operators to follow directions to suit him, he built the guide bar, now widely used.

He has not only used this method successfully for flat breaking and lister bedding, but for cultivation of crops as well. When the rows are long and curving on contour, a fleet of tractors can be set with these guide bars and will keep on plowing in a continuous round without the attention of an operator. Mr. Masten was also the first farmer in the South Plains to use pneumatic tires on a tractor.

The headquarters at Sudan, in Lamb County, Texas, bought in 1929, is typical of Mr. Masten's operations. Here broad fields of grain sorghum, awaiting the combine in mid-October, stretched almost as far as one could see.

"This 6,000 acres was all in sweet sudan one year, and you should have seen it," Mr. Masten said. "It was supposed to be the biggest sudan patch in the world at that time, and the folks here in town really got a kick out of

talking about it, since the town is named Sudan."

Wherever you go about the place, there's a spic-and-span, well-kept air that points out that a good farmer lives here. All labor on the place is on a wage basis, and homes for these workers are as modern as you'll find in any city. They're designed for compactness and space-saving, yet have incorporated into them every modern convenience and homemaker's aid.

F. O. Masten and his tenants expect to make between 7,000 and 10,000 bales of cotton this year on 14,000 acres. If you apply a little quick arithmetic to that, you'll discover a potential income of about $1,000,000 from cotton alone this year. However, it's a cinch that lots of it—maybe all—will go into the Masten storage, for he's a great believer in storing farm produce. "That's a substitute bank account for lean years, and they do come," he says. He keeps close tab on costs and production.

The grain sorghum harvest will be a heavy one on the Masten farm at Sudan this year. Some visiting experts have estimated 5,000 pounds of grain to the acre for some of it. "That may be a little high," Mr. Masten said, "but it had better be a heavy yield. You see, this is cotton land that was hailed out in June, and I had really poured the fertilizer to this section of the farm. I've got to get a good yield to come out on this part of it." And that's a pretty good index to F. O. Masten's thinking, for he likes to make each piece of land pay its own way.

Mr. Masten has worked hard all his life, and sees no reason to stop now. He's just as enthusiastic when he takes a visitor over the place and points out his irrigation wells, his fine crops, the homes of his employees, as when he's taking a good crop to market. He puts his car over a lot of highway in the course of a year, roving between the home place at Wellington, the grain sorghum patch at Sudan, or the cotton patch at Morton—that's a spread over three widely separated points in as many West Texas counties.

In the fall of the year, Mr. Masten has more real fun than at any other time. His hobby is boys—he has no children of his own—and he's practically adopted the school kids at Sudan, is one of the greatest boosters for their high school football team, tries to take in all their games. The fact that they have a fine stadium is an indication of some of his philanthropic interests, yet he doesn't like to have anything said about it. At Morton and Wellington, his interest is with the 4-H Club boys.

Dave Eaton, Lamb County Agricultural agent, says that many times he's had Mr. Masten drop in, ask about plans for taking some of the county youngsters t

a stock show or fair, ask how much money he would need to take care of all the youngsters, then write out a check and hand it over with the parting reminder, "Don't say anything about where this came from, for I don't want any publicity on it."

F. O. Masten has literally lifted himself by his bootstraps. From a $20-a-month farm laborer, he has risen to prominence as one of the outstanding, well-to-do farmers of West Texas. And he's kept his health and had a good time while he has done it. He is one who has rightfully earned the title of "Master Farmer."

Use Record of First Calf to Cull Heifers

They say looks are deceiving; and that's just as true with beef cows as anything else.

"Good looks" is not the best yardstick to use when picking out the cows to head up your beef herd, say animal husbandmen at the New Mexico Agricultural Station. ***The weight and gain of the cow's calf is a better guide. And the record of a heifer's first calf is enough to judge whether you should keep the heifer in your breeding herd.***

The New Mexico livestock men have records of 13 years' work with their 150-cow herd to back up their opinions. They find that if they had culled out the low 10% of their heifers on the basis of the showing made by their first calves, they would have missed on only two heifers out of a hundred in that time. Only those two would have later raised above-normal calves. That method is much more accurate than picking cows on their looks.

On this basis, you should expect every three-year-old that raises a lightweight and poor-grade calf to continue to raise that kind. The cows whose first calves are heavy and fast-gaining will keep up the good work.

Calves from heifers are always lighter than those from older, more mature cows. So if you use this system, you'll want to compare first-calves with each other, and the calves from older cows with each other.

You can now add beef cow selection to sire testing as a way to raise calves that gain fast in the feed lot and make a neat profit. In selecting both beef bulls and cows the real test is the kind of calves they produce—not how they look.

—*Farm Journal*

Improve Your Attack on Rats

Condensed from Capper's Farmer

Clyde Zimmerman

WOULDN'T you like a rat-size atomic bomb — something that would take the hard work out of controlling the pests? It certainly would pay off.

A hundred rats will cost you as much grain as 3 dairy cows. And you would like an easy way to rub them out for good. But there is no perfect poison, no quick end to this war. Still, you can get 50 to 90 percent of the sneak thieves at one time and keep the rest at bay. It means a good poisoning job, protecting buildings, and general clean-up.

Rats travel fast. Your efforts won't help much as long as there are plenty of boarders to move in. Talk to your county agent. Ask him to conduct a county-wide drive. He can get plans from U. S. Fish and Wildlife Service. Here's the way a drive worked in several Indiana counties.

Each county agent distributed thru schools a circular letter explaining the campaign and listing places where bait would be available. Post cards with the letters were used by farmers to order it. A few days before R-day, the county agent ordered bait from G. C. Oderkirk, district Fish and Wildlife agent at Purdue University.

The bait, ready-to-use, was shipped frozen. It consisted of a pound of meat and a pound of fish mixed with red squill and packed in paper cartons. Bait was kept in a cool place. Each packet contained an instruction sheet and made about 80 small baits, enough to cover the average farm.

Several counties have struck at rats thru 4-H clubs. The idea has been to pit 4-H'ers against each other with prizes for those who kill the most pests. In an Oklahoma county such a campaign was kicked-off in each club with a demonstration on mixing Antu poison with bait. The county agent delivered the poison to adult 4-H club leaders. The youngsters baited more than 600 farms. Since the weather was cold, and Antu a slow killer, most of the rodents crawled into hiding places to die. Altho not a great number were found, much less rat damage was noticed the next spring.

Iowa State College suggests a 3-point program. The first step is to clean up. Get rid of trash piles. If you have a stack of lumber, set it on stilts, up at least 18 inches. If there is plenty of space under such piles, dogs can get at rats.

Next, prebait around buildings. Offer them something not in their

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Topeka, Kansas, January 1950

regular diet, such as kitchen scraps or ground meat. Keep this up for 3 nights, increasing the amount until you are putting out all they will eat in an hour. Now you have them expecting to be fed. Your are ready for the kill.

The food that is selected as bait and the way it is exposed are more important than the poison itself. If rats are accepting the untreated food, there are a number of poisons palatable to them that will produce good kills. Red squill, already mentioned, is relatively harmless to humans, pets and poultry. However, a rat that recovers from it won't eat red squill baits for a long time, if ever.

Antu is one of the most toxic compounds for brown rats that is generally available. Use it cautiously, according to instructions, for it will kill young chickens, hogs, dogs and cats, and will remain poisonous for a long time after it is spread. Rats can detect it in baits. Also, sub-lethal doses confer immunity. So rodents will either leave it alone or build up a resistance. The Fish and Wildlife Service recommends that Antu not be used again in the same area for at least 1 month and preferably 3 to 6 months. The Service says there is indication that Antu works best in warm weather.

You can mix the poison with 1 pound of freshly ground hamburger and 1 pound of oatmeal. Another mixture is 1 pound of ground bread crumbs, ¼ cup peanut butter and ¼ cup molasses. The poison can be sprinkled over fruits and vegetables cut into small pieces and moistened with water. Ready-mixed bait containing Antu is also available in collapsible tubes. The morning after spreading, all uneaten baits should be burned or buried deeply. That goes for any poison you use.

Barium carbonate is both tasteless and odorless. Rats that recover from it will eat barium carbonate baits again without hesitation. But it is poisonous to domestic animals.

A professional exterminator would probably use 1080, altho it is so dangerous that some men are afraid of it. It is not generally available, with good reason. One rat lying dead from 1080 could kill off all the cats, dogs, pigs and chickens on a farm. There is no known antidote.

The best killer of them all may be a newcomer, now called Compound 42. It causes internal bleeding. It is a relative of dicoumarol, the substance found in spoiled sweet clover that prevents blood clotting. With it, the Fish and Wildlife Service has had 100 percent kill in the laboratory. It requires 4 to 5 successive feedings. But rats don't learn to avoid it, nor do they develop any tolerance. Compound 42 is not harmful to humans or to larger animals in the dosage recommended for baiting. The antidote is a blood trans-

fusion or injection of clot-promoting vitamin K.

Remember that poison bait should be fresh and distributed over your farm at the same time in the evening as prebaiting was done. You can obtain help from your county agent on the best ways to place poison and how to make bait-boxes that will keep it out of the way of farm animals and poultry.

Grain and feed bins can be protected with metal flashing on all corners or lining with metal or cement-asbestos board. Wooden slat cribs should be off the ground, preferably about 2½ feet. Piers that hold the crib up should be glazed pipe, metal drums, or wooden pilings protected with metal bands or inverted pans at the top. Another method is to put hardware screening under floors and around the sides to a height of 2 or more feet. Overlap the end of the mesh with a 2-foot band of smooth metal. This prevents the pests from climbing sides. On wooden cribs, all doors and opening should be flashed with 24-gauge galvanized iron. Keep stacked material, rubbish and machinery away from the crib.

Temporary cribs of snow fence or wire netting are usually placed on the ground or on wooden platforms 3 or 4 inches off the ground. This serves as permanent living quarters for the farm's rat population. Such cribs should be on a wooden platform elevated at least 18 inches. A sheet metal band can be placed around the outside of the fencing as for the wooden slat crib.

Foundation walls of granaries with concrete floors should extend under ground 18 inches to 2 feet. This discourages burrowing underneath. By making the base of the footing 4 to 6 inches wider than the rest of the foundation wall, a ledge results which seems to baffle rats.

The Mathematics of Growing Corn

Condensed from The Southern Planter

Malcolm H. McVickar

GROWING 100 bushels of corn to the acre is just a matter of arithmetic: Add plenty of fertilizer, divide the proper number of fertile hybrid kernels over the acres, subtract poor cultural practices, then watch the ears multiply!

Agricultural researchers have found that 100 bushels of corn to the acre will exhaust nature and the fertilizer bin to the tune of about 140 to 160 pounds of nitrogen, 80 pounds of phosphoric acid

Reprinted by permission from the Southern Planter
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and some 100 to 125 pounds of potash. Converting these figures to "in-the-sack" terms, this would mean the equivalent of the plant food in 875 to 1,000 pounds of nitrate of soda, or 500 to 625 pounds of ammonium sulphate, 400 pounds of 20 per cent superphosphate and 200 to 250 pounds of 50 per cent muriate of potash.

These fertilizing elements not only must be present in order to shoot at the 100-bushel mark, but they must also be *available*. Different soils vary widely. Rich, friable productive soils will give up more of these elements to the growing corn plant. Unproductive soils will let go with much less. If a farmer has a soil map of his farm—in reality an inventory of his soil resources—the calculation of the ratio and amount of fertilizer he needs will not be altogether a pure guess.

It is necessary to remember at this point that a considerable portion of the phosphorus applied to the soil becomes fixed; that is, tied up so that it cannot be used by the growing corn.

Scientists are now hard at work with radioactive phosphorus at several points throughout the United States. This bids fair to reveal the proper ratio of phosphorus that needs to be applied as fertilizer in the mathematical corn production formula.

Other raw materials are needed: Some 5,000,000 pounds of water, or the equivalent to 21 inches of rainfall per acre. This water serves as a conveyor of plant nutrients within the soil and also as a channel within the plant. Water is made up of two elements, hydrogen and oxygen, and both are important plant foods. This amount of water seems large, but seldom fails, especially if proper cultural and conservation practices are observed.

Before it consents to shell out 100 bushels per acre, corn demands more items, such as 5,200 pounds of carbon, the amount in approximately four tons of bituminous coal; 50 pounds of magnesium, or what is contained in 500 pounds of Epsom salts; and 50 pounds of calcium, as much as there is in 125 pounds limestone. Almost all of the carbon is derived from carbon dioxide in the air and only a tiny part from the soil; thus, for all practical purposes, the carbon is readily available.

Minor elements needed in small quantities, but nevertheless vital, amount to 1/3 pound manganese, 3/50 pound of boron, 20 pounds of sulphur and just a trace of iodine, zinc, iron and copper.

The foregoing is the box score of elements and water essential to producing 100 bushels of corn per acre; and again, these substances must be in the available form. Those elements which the soil cannot supply must be fur-

nished in the form of fertilizer, lime, manure or other soil building materials.

Fortunatey, the average farmer concerns himself for the most part over the Big Four: Nitrogen, phosphorus, potash and lime. The majority of our soils are satisfied as regards the other elements. But, if deficiencies are thought to exist in soils on individual farms, a letter or visit to the state experiment station usually gets the answer. Making sure that these ingredients are available is *Step 1* in the grand plan of 100-bushel-to-the-acre corn production.

Present research proves beyond a shadow of doubt that big, long ears of corn—the result of thin planting rates—is by far the least economical method of raising corn. These yellow amazons stand out at the county fair and often bring home coveted prizes . . . but the land and its wealth are not being utilized to their best advantage. The agricultural researchers have found—and their findings are corroborated by farmers themselves—that highest yields are obtained from single-eared hybrids so planted that each mature ear weighs in the vicinity of one-half pound. This means that approximately 14,000 to 16,000 plants per acre will come close to being the correct planting rate for that 100 bushels of corn from each acre.

This planting rate would mean one stalk every 9 to 11 inches within 40-inch rows. If a two-eared variety is planted the plants need not be quite as thick; some 10,000 to 12,000 plants per acre would be about right. Making sure that enough plants per acre are used is *Step 2* in the formula of successful corn production.

As for *Step 3,* plant an adapted hybrid. All state experiment stations conduct yield tests with many hybrids and make recommendations on the basis of these tests through county agents, vocational teachers and other professional workers in agriculture.

Step 4, the last, concerns cultivation. Emphasis today is toward less cultivation—only that necessary to control weeds and to break the crust that develops on certain types of soils. The era of many and heavy cultivations is definitely over. The root system of the corn plant is large and extensive, particularly during the latter part of the growing season. Deep and late season plowing breaks off many of the small "feeder roots" and actually does more harm than good.

Weeds should be controlled, certainly, but the time for this is when the corn plants are small. Success with 2,4-D as a weed killer in corn during the past seasons may completely revolutionize corn cultivation and mark the decline of the mechanical cultivator.

Farmers have realized the enjoyment of weighing in 100 bushels of corn from an acre. Others will in 1950 and the years to follow. Perhaps 200, or even 300 bushels per acre will be the usual thing some day. It is not likely that even 25 bushels of corn were given forth from an acre of soil back in Biblical times when this holy and time-honored passage of Scripture was written in Mark 4:28, *"For the earth bringeth forth fruit of herself; first the blade, then the ear, and after that the corn in the ear."*

Disease-Free Corn?

Everybody knows how hybrid corn can yield, but less has been claimed for its disease resistance.

Now it looks as if disease-resistant strains are on the way.

With open-pollinated corn, such as we used to raise before hybridizing was worked out, the breeder had no way of keeping a disease-resistant line pure. With hybrids he can.

Corn breeders around the country now think that the way to get a disease-resistant corn is to subject it by artificial inoculation to all possible ailments. The next step is to develop inbred lines from surviving plants, then go on in the usual way to make hybrid corn.

To get an idea of how this works, let's visit the corn plots of C. C. Wernham of Pennsylvania State College. He plants seed in soil that has been growing corn for years. To make sure that seedling rot organisms are present he "plants" some of them, too.

When the plants are 6 to 8 inches high, Wernham inoculates them with leaf blights. Then about 20 days before the tassels come out, each plant is injected with a suspension of smut spores collected in different localities in the state.

All of the surviving plants are self-pollinated, and then inoculated with stalk rot. So far Wernham has relied on natural infection for ear rot.

His corn plots are so full of disease that few plants from most lines survive. In many cases none have lived through inoculation, but he has one inbred selection from an open-pollinated variety which has thrived.

First crosses of a disease-resistant parent from Florida produced leafy two-eared stalks which had visiting farmers talking last fall. And, best of all, he has small amounts of seed from 217 other lines which have survived the treatment for 2 years.

—Farm Journal

Balut—A Duck-Egg Delicacy

Condensed from Foreign Agriculture

Hubert Maness
Agricultural Attache, American Embassy, Montevideo, Uruguay

A DUCK-EGG delicacy, unknown to the rest of the world, has given rise to a flourishing duck industry in the Philippines. Especially preferred by the Tagalog people in and around Manila, the delicacy is known by the Tagalog word, "balut." It is, in brief, unhatched duckling. As popular in Manila as "hot dogs" in the United States, millions of these eggs are sold by peddlers every year along the streets of the city.

In the preparation of balut, a duck egg is kept in an incubator until it is almost ready to hatch. It is then removed and hard-boiled in the shell.

Nobody knows how long the Tagalogs have eaten this exotic food, but the custom may be centuries old, since the Philippine duck industry began hundreds of years ago, probably with the arrival of the Chinese traders. The Chinese, in order to get protection from typhoons, established their early settlements along the shores of Laguna de Bay, a freshwater lake drained by the Pasig River, which in turn runs through the modern city of Manila.

One of their early villages was later renamed Pateros (Duck Raisers) by the Spaniards because of the large number of ducks found there at the time of the Spanish conquest. The raising of egg-laying ducks is still the principal business of Pateros. Although there are about 400,000 ducks in the village flocks, they do not produce enough eggs to meet the demand for balut, and millions of eggs are imported annually.

Duck eggs are hatched in homemade bamboo incubators shaped like a barrel. The incubators are placed, close together, in a large, specially constructed incubating room. The floor of the room is covered with about 2 feet of rice hulls, which help to absorb the humidity.

The incubators are in reality large woven bamboo barrels about 3 feet high and 2 feet in diameter, fitted to hold 10 round trays, one placed on top of the other. The trays also are made from woven bamboo and hold from 100 to 120 eggs each, depending upon the size of the eggs. Thus one hatching barrel holds from 1,000 to

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Washington, D. C., January 1950

1,200 eggs. The rest of the equipment is also homemade and simple. It consists of rice hulls, abaca mesh bags, a copper kettle, and coconut hulls or charcoal, which is used as fuel. In preparing the incubator, rice hulls are heated in the copper kettle until they are very hot and dry. They are then put into abaca bags. One of these bags is loosely fitted into the bottom of the barrel, then an egg tray goes on top of that, followed by another bag and a tray until the barrel is full. Over the top is placed a bag of heated unpolished rice, because unpolished rice holds heat longer than the hulls. Finally the assembled incubator is topped with a large, heavy abaca cloth.

Three times every 24 hours the egg trays are removed and the eggs are turned by hand. During turning, they are sprinkled with water if atmospheric conditions warrant it. The rice bags are replaced with hot ones whenever necessary. During the height of the hot season, they are generally changed only once a day, in early morning when the temperature usually drops.

Because of their long experience the men operating the hatchery do not use a thermometer to test the temperature of the eggs; instead, they place them against their cheek or eyelid. The eggs are candled after 8 days, and the infertile ones are removed. Such eggs are then boiled until hard and sold under the name of "penoi," which is considered inferior to "balut."

The remaining eggs are left in the incubator for an additional 10 days, after which they are removed, boiled until hard, and marketed as balut.

These eggs are sold by peddlers along all the principle streets of Manila. They are kept warm in small well-covered baskets. To the Filipinos who eat balut, it takes the place of meat since the embryo is well-formed and has a meat flavor. The hard-boiled yolk is considered very tasty because of its cooked-blood flavor, and the juice is drunk with great gusto. When the Tagalogs eat balut, they crack the egg at one end, drink the juice, and then pick out the content with their fingers.

This duck industry is made possible and economical by the freshwater lake, Laguna de Bay, which contains almost unlimited amounts of snails and other aquatic duck food. Laguna de Bay, just southeast of Manila, is 25 miles long and 21 miles wide and covers an area of about 350 square miles. Its outlet is the 12-mile-long Pasig River. One of the most picturesque and interesting sights in the world is the water front with the thousands of duck runs, thickly placed along the shores. Each run is filled with hundreds of ducks of various colors—white, brown, black, and

combinations. Each run is separated from the other by only a few feet of low bamboo fence.

Since the primary purpose of keeping ducks is for egg production, a remarkable nonbroody strain has been developed. It is a small duck similar to the American mallard. Many of the duck raisers claim that their flocks average from 150 to 180 eggs annually and that individual records of 250 eggs are common. The ducks lay the year round with only slight fluctuations between the rainy and dry seasons.

The owners state that the ducks seldom fly out or stray from their pens, but, if they do, they always return to the place where they were raised. At night the ducks are put into bamboo enclosures adjoining the run and are released after they have laid their eggs the next morning. The floors of the roosting pens are covered with rice hulls, and the ducks drop their eggs during the early hours of morning. The main diet of the ducks consists of snails, which are collected around the edges of the lake and given to them in generous amounts. Young ducks are fed rice in addition.

The eggs kept for replacing the breeding stock are hatched in the same way as for balut, except that they are incubated 28 to 30 days. The ducklings are generally hatched during August or September so as to mature in the coolest season of the year. According to several breeders, it is not uncommon to get a hatch of from 85 to 95 percent.

The ducklings are separated soon after hatching, and only the female ducks are raised by the big producers, the drakes being sold to small home raisers. For a long time I was puzzled to see, in the public markets of Manila, hundreds of ducklings being offered for sale at 15 cents apiece side by side with fresh duck eggs costing 25 to 30 cents each. The mystery was solved when I discovered that the ducklings were all drakes, the "ugly ducklings" of the balut industry.

When the ducks are 2 years old, they are generally sold for meat. From these old ducks the Tagalogs prepare the delectable dish, "dinogog." For this the birds are dressed and cut up into small pieces and steamed with small slices of green papaya, which makes them tender. Then various vegetables and herbs are added, mainly fresh ginger roots, green onions, and cabbage leaves. Many countries have dishes similar to dinogog, but none has anything quite like balut.

Insulated "A" In Mixed Feeds

Condensed from Hatchery & Feed

John M. Herrold

While the value of vitamin A, as well as the need for addition to many foods and feeds, has been established beyond question, the problem has been to make it "stay put" in various products to which it has been added.

The rate at which fish oil vitamin A and carotene deteriorate in mixed feeds depends upon numerous factors. These factors are:

1. *Storage temperature*—Loss of carotene from alfalfa varies from 2 percent per month during cold winter months to more than 20 percent in summer. Fish oil vitamin A also deteriorates faster in mixed feeds during hot summer months.

2. *Air circulation*—Freely circulating air tends to destroy vitamin A and carotene. For example, less carotene is lost from bags of alfalfa meal in the center of a stack than from those around the edges.

3. *Exposure to light*—Feeds stored in direct sunlight quickly deteriorate in vitamin A and carotene content.

4. *Fineness of ingredients*—When mixed with fine, powdery feedstuffs, vitamin A oil is spread over a greater surface area, increasing chances for destructive oxidation.

5. *Concentration of oxidizing minerals*—Direct pre-mixing of any vitamin A and D oils with ground limestone, bone meal, iron oxide, charcoal, iodine and manganese results in greatly accelerated oxidation. When you detect an odor like that of drying paint in a feed containing a vitamin oil, you can be sure that rapid oxidation is taking place. In most finished poultry mashes, the concentration of these oxidizing minerals is low enough to be relatively easy on the Vitamin A. But some special feed concentrates or supplements may have a concentration of these minerals which normally is very destructive of Vitamin A. [At least one company has developed a process for preventing oxidation of vitamins by certain minerals.—Ed.] Insulated vitamins introduced into this picture assure their presence in the feed when it is consumed by the fowl.

6. *Concentration of anti-oxidants*—Soybean oil meal, cotton-

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Mt. Morris, Illinois, December 1949

seed meal, corn meal, wheat germ meal, ground oats and a few others contain natural anti-oxidants that help protect Vitamin A. Certain combinations of anti-oxidants are effective and have been used in making the simple, conventional dry Vitamin A and D carriers. This, however, is not the main reason for the effectiveness of the more modern, improved processes which have been found to insulate Vitamins A and D against losses in the finished feeds.

7. *Concentration of other Vitamin A destructive feed ingredients* —Milk by-product in dry form, meat and bone meal, fish meal and blood meal may have a tendency to destroy Vitamin A in ways which are not well understood.

These seven points cover the various aspects of a problem which is now almost completely solved by proper insulating processes.

Vitamin A and D carriers for poultry mashes made two distinct changes within recent years.

The first step, was, of course, Vitamins A and D in oil form. The relative instability of this this Vitamin A, when finally mixed with the finished feed, was quite well established over the years.

The war, with its accompanying fat shortage, produced the second step. The concentration of vitamins A and D in oils was increased by special blending so that mashes could still be fortified with the same number of vitamin A and D units, but these were carried in a smaller poundage of oil.

After long effort, it is now possible to obtain vitamins A and D in a dry form in which both vitamins will remain thoroughly stable in ordinary feeds. In fact, this research has been so successful that the vitamin A, insulated in dry form, will also remain stable for many weeks and months in most commercial mineral preparations. From a generally practical standpoint, the problem has been solved.

These new, stabilized dry vitamin A and D preparations are so unusual that a modification of the standard vitamin A assay routine is required in order to properly assay them. This modified procedure has been well established and the details are now known to commercial and private assay laboratories. Some of the feed manufacturers having laboratories of their own assisted in these research developments and were testing the products side by side with the manufacturer. This cooperation and teamwork greatly speeded up the time at which stable vitamin A products could be released to the trade.

Boucher, of the Pennsylvania Station, reported in Pennsylvania Station Bulletin 480, July 1946, that 21 to 27 percent of the vitamin A was lost from a chick starter mash during 12 weeks of storage and 52 to 56 percent dur-

ing 24 weeks storage. The chick starting ration was stored under practical and usual conditions of storage in cotton bags in an unheated room.

Contrasted with these results is a sample of the New England College Conference Egg Mash which was enriched with an ordinary dry vitamin A preparation to an initial assay level of 266 units of A per gram and lost 30 percent of its vitamin A in the equivalent of four months of storage at room temperature. Only two percent of the vitamin A was lost under the same time and temperature conditions in the New England College Conference Egg Mash enriched with one of these insulated dry A preparations to an initial assay level of 125 U.S.P. units of A per gram.

Distillers' solubles enriched with ordinary dry vitamin A to a level of 220 units per gram and stored at an incubator temperature of 98° F., representing two months at room temperature, showed a loss of 27 percent whereas there was no loss in eight months with the insulated dry vitamin A under the same conditions.

In another test of stability, cottonseed meal was enriched with the insulated straight vitamin A dry product to an initial test level of 212 U.S.P. units of A per gram. After one month at 98° F, there were 202 units of A per gram and after two months there were 197 units remaining.

These results indicate excellent stability since two months at 98° F is considered equivalent to eight months at temperate climate.

As another example of the improved stability of vitamin A under the new processes, we may take the case of a mineral mixture composed of 40 percent bone meal, 40 percent ground limestone and 20 percent of salt. When this mineral preparation was enriched to around 200 to 250 units of vitamin A with fortified cod liver oil and another sample with the new, stabilized dry products, the loss was 97 percent in two months for fortified cod liver oil and no loss for the new, stabilized product in four months. Ordinary dry vitamin A preparations showed losses of 16 to 59 percent of the added vitamin A in four months. In fact, the cod liver oil vitamin A may have been lost during the first few days, for the sample smelled rancid three or four days after it was mixed.

Fritz, Archer and Barker reported in Poultry Science, volume 21, 1942, the stability of vitamin D from fish oil when mixed with various substances. For instance, when dried whey was fortified to levels of 400 AOAC Chick Units of vitamin D per gram, less than 50 units remained two months later and in some cases the vitamin D had completely dis-

appeared after only one month of storage. Since vitamin D is regarded as a fairly stable vitamin in contrast with vitamin A, it may logically be assumed, in these studies with vitamin D in dried whey, that when the vitamin D was destroyed, the vitamin A also was thoroughly destroyed.

The new, stabilized preparations have been laboratory-tested. In this unpublished work, stabilized vitamin D_2 showed no loss when stored for three months at 98°F, in a product where dried whey was the major component.

In the old days, we knew that carotene and vitamin A in mixed feeds stored at room temperatures deteriorated from the moment the feed was mixed until the time it was consumed by the chicken. On the other hand, the new, stabilized vitamin A and D carriers can be stored or put into a mixed poultry feed with assurance that both vitamins will "stay put" until the chick or hen consumes them.

This Spray Makes Bug War Easier

Now you can buy a one-package spray mixture good for all the fruits you grow.

Commercial orchardists have the tools and equipment to mix a lot of chemicals together. But most of us, who have only a few trees, often have neither the time nor the equipment to do a good job of mixing.

Prof. C. L. Burkholder, horticulturist at Purdue University, and V. H. Davis, horticulturist with the Ohio Farm Bureau, decided that farm and home orchardists ought to have an easier way of spraying.

As a result, they came up with an all-purpose spray mixture containing DDT, arsenate of lead, and Fermate (ferric dimethyl dithiocarbamate). The first two chemicals kill bugs, the last one discourages fungous diseases.

This spray, when applied correctly, controls practically every pest on apples, pears, peaches, cherries, and grapes.

It is distributed by Farm Bureau Co-operatve Associations throughout Ohio and Indiana. One pound makes 10 gallons of spray. To use it as a dust, mix it with an equal part of flour.

—Farm Journal

Farmers—Winds—Soil

Condensed from The Western Farm Life

E. L. Brandner

ONE of the worst beatings High Plains farmers ever took was at the hands of winds that lashed across the Midwest in the 1930's. Farmers stood helplessly by and watched great, black clouds roll in across their soil and move on, carrying rich topsoil with them.

Many farmers and ranchers of the plains region, concerned lest dust-bowl conditions return, are using knowledge gained during the 1930's, such as letting the land rest in summer fallow. Last year, for instance, Kansas farmers had 3,500,000 acres idle. But conservationists have felt the need for more basic knowledge about wind erosion and its control.

To fill this gap, Kansas State College in Manhattan and the USDA Soil Conservation Service are co-operating in a study of soil erosion by wind. Scientists working at K-State have built a wind tunnel to use in their studies. With the tunnel they are recreating dust-bowl conditions and applying studies they hope will solve, or at least help to solve, dust-bowl problems. They want to find out how, when, why, where and how much soil the surface winds move.

Starting a little more than a year ago with a $30,000 annual appropriation, the scientists have built a 56-foot permanent wind tunnel, a portable tunnel to be moved onto field locations, and a soil separator. They have regulated winds created by a 4-foot ventilating fan so the tunnel winds duplicate those that sweep across farm land.

The biggest problem before actual experiments began on the soil's reaction to certain winds was to make the "wind" in the tunnel duplicate atmospheric winds. Modifications were necessary to remove rotation and other non-uniform wind characteristics from the artificial air stream. To "straighten" the wind from the fan, it is run through a honeycomb section of 324-foot-long, 2-inch aluminum tubes.

Wind velocity is regulated by throttling the power unit and by opening or closing vanes in the fan's air intake. Controlled winds up to 40 miles an hour are now produced in the tunnel. A 40-mile-

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an-hour wind 1 foot in height equals a wind of hurricane proportions as recorded by weather station wind gauges 60 feet above the ground.

The wind tunnel at Kansas State College has glass along its sides enabling scientists to see what happen as the winds sweep across their experimental plots of soil. The tunnel also has built-in gauges for measuring air velocities at different points. Slits across the tunnel roof permit use of a multi-alcohol manometer. The manometer is simply a series of glass tubes open toward the wind and connected by rubber hose to glass tubes filled with fluid outside the tunnel. Levels to which the fluids rise in the outside tubes tell the observer the velocity of the wind at various heights in the tunnel and at various distances down tunnel. To get precise data associated with the velocity of wind, micrometer height adjustments to 0.001 of a foot have been used.

A. W. Zingg is in charge of the project under H. E. Myers, head of the Kansas State agronomy department. W. S. Chepil is the soil scientist.

Zingg has worked as a soil conservationist, agricultural engineer and flood control specialist. Chepil came to the K-State project from Saskatchewan, Canada, where he was making wind erosion studies at the dominion experiment station at Swift Current. He had done research on wind erosion in Canada since the 1930's.

The federal research and marketing act of 1946 made funds available for similar studies in the United States. Kansas State College was chosen as the site of the only such project in this country. The college campus is on the extreme eastern edge of the Great Plains area, but it was necessary to place the studies near a chemical analysis laboratory. Physical and chemical properties of soil are important factors in the soil's erodibility or its resistance to blowing.

Studies to find what physical and chemical properties of Great Plains soils have to do with wind erosion are now in progress. The soils are analyzed in physics and chemistry laboratories, then tested in the wind tunnel. From these studies may come recommendations for a cementing or binding material that will hold the soil together so it will not blow. Of course, any binding material used must have no harmful effects on the soil's productivity.

By forming minute ridges, hills and ravines in the wind tunnel, the scientists hope to find how deep a furrow is needed to hold blowing soil, how far apart the furrows should be—or if a furrow is the best method. Perhaps a plow, duck-foot or some other farm implement would be more effective. Or their studies could lead to need

for a special farm implement not yet manufactured.

Early tests show that gusts of wind near the surface of soil are four or five times as strong as the average velocity of the wind. By studying a 74-year history of wind movement, moisture and temperature, the scientists found that air becomes laden with dust when the average wind velocity for an hour's time exceeds 16 miles an hour.

Low rainfall in the July-to-December period is associated with high April winds the next spring. The studies also indicated a possible 8-year cycle. "But the cycle does not occur regularly," Scientist Chepil hastens to point out, "so it may have no significance at all."

Lime applied to soils studied in the K-State laboratories caused an almost immediate decrease in their cloddiness. However, soils treated with lime became finely granulated and highly susceptible to wind erosion. Plains soils generally are high in lime content. This factor alone may cause them to be susceptible to erosion by wind.

Zingg and Chepil are now experimenting with substances which they hope may have the opposite effect on soils—that is, substances that will cement and bind soil particles to protect them from blowing. Three possible soil binders now being tested are asphalt, resins and agricultural organic materials such as wheat straw. Discovery of a material to bind the soil as well as lime loosens it would be a boon to the Great Plains farmer.

In preliminary tests, organic matter added to soils had virtually no effect on clod structure. Also, the organic materials appeared to have no effect on the water-stable structure, a month after treatment.

Chepil and Zingg have scientific proof that the size of soil fractions blown about by wind is less than ½ millimeter in diameter, or about the size of finely granulated sugar. Particles between ½ millimeter and 1 millimeter in diameter are a small part of the material moved by erosive winds. And soil grains beyond 1 millimeter in diameter can be considered non-erosive, Chepil says.

Contrary to general opinion, fine dust (less than 0.05 millimeters) also resists blowing by wind. Soil will not produce crops if it is made up of the particles so small they will not blow. So an important aspect to farming the Great Plains is to use cropping and tillage methods that leave the soil aggregates larger than 1 millimeter in diameter.

Silt lifted into the air and moved great distances from eroded areas has been found to measure less than ½ millimeter in diameter. Data collected by Chepil and Zingg indicate that approximately 4/5 of the total dust content

moved by the wind was lost to the atmosphere in a single dust-storm.

The scientists are busy now developing formulas by which they can predict reactions of a given soil to a given wind. Into the formulas must go factors to cover wind velocity, crop cover, crop residue and rainfall—all of which are important to the soil's ability to resist blowing.

Experimenting is a long, tedious task. This was shown by the 50,000 tests needed to "straighten" wind from the fan so it duplicates atmospheric winds. Before a scientist releases recommendations, he must be certain they are reliable, Zingg emphasizes. "We are not that far along. However, if winds start moving topsoil, we have theories we will put into action."

Meanwhile, Zingg, Chepil and their associates on the wind tunnel project will continue investigating causes for wind erosion and developing methods to combat any recurrence of dust-bowl conditions.

Hybrid Corn Goes to Italy

Hybrid corn has jumped the ocean to Italy. It offers that hungry land its "greatest opportunity to make the quickest advance in food production," according to Harry McClelland, food and agriculture chief in Italy for the Economic Co-operation Administration.

It also offers opportunity to U. S. corn breeders. ECA guarantees any who want to go into hybrid seed corn production there the right to take their earnings out of Italy in good American dollars.

Unlike most Europeans, Italians eat corn—at least they do north of the Po River. They make a thick corn meal mush and fry it.

Already Italy has 2.5 million acres of corn, with ordinary varieties yielding up to 40–45 bushels per acre on good farms. Hybrids may boost those yields to as much as 65 bushels. Prewar average for all Italian corn was 28 bushels per acre.

Immediate plans are to encourage use of U. S. hybrid seed. Italy already has bought 80,000 bushels of seed for the 1949 crop. These are varieties already proved in tests in Italy in 1947 and 1948.

The long-range program is for Italy to develop her own hybrids and make the Po valley the center of hybrid seed corn production for all of Europe.

—Farm Journal

Don't Fool With Electricity

Condensed from the Dakota Farmer

ELECTRICITY is a wonderful and inexpensive hired man and it will serve you well if you observe some of the common-sense safety practices.

First of all, those harmless looking wires and sockets are surging with current powerful enough to flip anyone on his back—too many times for keeps. Observe good safety practices when using electrical appliances and your electrical hired hand will do his duties quietly and efficently.

If you use an electric heater in your bathroom, set it far enough away from the tub so that you cannot reach it from there. Then you won't be tempted to switch it off and on while in the tub for, should there be a short in the switch or mechanism, your wet body allows even more voltage to shock you. The same holds true for a radio. Switch on your favorite program before you step into the water, then stay away from it. Around the kitchen, too, or anywhere for that matter, never touch a switch or appliance plug with wet hands. Extra care should be taken with children in the home.

It may look neater not to have lamp cords in plain sight, but don't hide them by running them under rugs. Besides pulling the rug out of shape, the constant friction caused by feet walking over that rug is apt to wear off the insulation of the cord.

Keep cords of appliances out of water and off damp floors. If the cord happens to be damaged, moisture getting at the wires may cause a short that will start a fire before a fuse blows.

You won't get maximum light from a dusty fixture, but before giving it the soap and water treatment, turn off the light and let both the fixture and bulb cool thoroughly. Water on the hot glass may cause it to crack or even explode.

Does your iron plug smell hot? Did you notice sparks when you plugged in the toaster? Don't wait to see what will happen but disconnect equipment at the first hint that something is wrong. Let the repair man check up on the trouble or you may find yourself with a bigger repair bill than necessary, because you left equipment connected too long.

All milking machines should be well-grounded—watering cups and metal stanchions also. Failing to ground stanchions properly may

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result in a severe shock or even electrocution for your cows.

Electrically-heated watering fountains should be grounded.

Inadequate wiring is one of the biggest causes of accidents and inefficient electrical service on the farm. According to farm electrification experts, unnecessarily high electric bills and inefficient operation of electric equipment are the price a great many American farmers are paying for the continued use of obsolete and inadequate electric wiring systems. They point out that a great many present day farms were wired originally for lights and a few small appliances only. Now, with the tremendous increase in the application of electric tools and machines on the farm, wiring circuits are overloaded to a point where power is being lost and voltages substantially lowered. This can mean dim lights, stalled motors, and more frequent repairs on electric equipment.

Citing the extensive use of electric milkers, barn cleaners, automatic water systems, soil heating cable, and welders, among other farm devices, experts urge the adoption of wiring systems with sufficient circuits and protective devices to distribute safely the electricity required by this labor-saving equipment.

One of the best indications of inadequate wiring is the continued use of extension cords. Long extension cords are a bother and a nuisance. Besides being a constant menace, waiting to coil around your leg and trip you, they are in your way on cleaning day. Several short extensions, coupled together to make one long enough to reach clear across the room, are an even less-desirable arrangement. The extra plugs used for coupling are likely to get stepped on or pulled half-way apart, causing a short. Best to call your electrician and have him add several more outlets in convenient places. If you are just doing your wiring, be sure to have plenty of outlets put in. It is cheaper to have it done at the time of wiring. There should be at least two in each room downstairs and very likely you will want more than this in the kitchen. Better to put in more outlets than you think you will need. As you will find yourself depending more and more upon your electrical hired hand.

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An excellent text and reference book for those concerned with crop production. The major crops are grouped into chapters in accordance with their botanical relationships. The general principles of crop production, the crops of the Grass family, the Legumes and the crops of other plant families covering both forage and industrial crops are presented. Well illustrated.

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John Wiley & Sons, Inc. — 280 pages — $3.25

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The world reserves its big prizes for initiative . . . and that is

- *Doing the right thing*
- *At the right time*
- *In the right way*
- *Without being told.*

—Thomas A. Edison